

South Florida Water Management District Land Stewardship Division



Allapattah Flats Management Plan (2004 – 2009)

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1. Executive Summary

Allapattah Flats was placed on the District's Save Our Rivers (SOR) and the State's Conservation and Recreational Lands (CARL) acquisition lists in 1996. The state project encompasses 36,000 acres. The Save Our Rivers project includes 22,560 acres, but the boundary included in the Indian River Lagoon (IRL) study covers more than 42,000 acres. The property is located in northern Martin County, directly adjacent to the C-23 canal (Figure 1). Allapattah was identified as a key component of the Indian River Lagoon South Project Implementation Report's recommended plan, which calls for restoration of the Lagoon through watershed retention of excess flows in 91,000 acres of reservoirs, stormwater treatment areas, and on-site retention in natural wetlands (Figure 2).

The District and Martin County have purchased fee title to 21,000 acres within the SOR and IRL project footprint (Figure 3). While some high quality natural systems still remain on Allapattah, the great majority of the property has been heavily impacted by agricultural clearing and draining. The USDA Natural Resources Conservation Service (NRCS) provided major financial assistance by acquiring a conservation easement over 15,000 of those acres from the District and Martin County under the Wetland Reserve Program. Three major canals and numerous secondary ditches and swales drain the property into the C-23 canal.

A resource inventory was conducted by Florida Natural Areas Inventory (FNAI) in 1995 which describes the property as having exceptional wildlife habitat for game and non-game species largely due to the large, undivided size of the project. Following the purchase of Parcels A & B (approx. 13,000 ac.), community mapping and additional inventory work were conducted which describes 13 natural communities (Figure 4).

In addition to providing acquisition assistance through purchase of the conservation easement, NRCS is also funding 75% of the restoration costs under the Wetland Reserve Program (WRP). WRP provides funding for restoration of wetlands that have been impacted by agriculture. Restoration activities on Allapattah that are covered by WRP must be completed in five years. (Schedule and Budget: see Appendices A and B) These efforts will include filling of drainage ditches, construction of perimeter berms to prevent flooding of two county highways (CR 609 & 714), and construction of water control structures to allow discharge during extreme high water conditions. These goals will be accomplished while maintaining existing levels of flood protection for adjacent properties. Increased on-site water storage will reduce peak discharges to C-23 and the Indian River Lagoon and will provide important year round groundwater baseflow discharge of freshwater to the Lagoon. The complete restoration plan is included as Appendix A.

Over the next five years the District's management efforts will include treatment of exotic vegetation and prescribed burning (both begun in 2003), reforestation of former pine flatwoods (begun in 2004), and implementation of a public use program in conjunction with the Florida Fish and Wildlife Conservation Commission. It is

envisioned that public use will include limited quota-type hunting under a wildlife management area designation in areas not undergoing restoration. Hiking, bicycling, and equestrian use will be accommodated on separate trails in the Cottage Rough Management Unit, north of CR 714, in Parcel A. Management activities for many years have been directed around the operation of Allapattah as a cattle ranch, which focused on maximum production of forage grasses. Cattle grazing will continue, but with the objectives being to assist land management efforts by maintaining optimum levels of native forage and biomass reduction. Grazing plans have been prepared by NRCS for Parcels A, B, and C and are included as Appendix B and will be updated periodically as restoration progresses.

2. Management Plan Purpose

The purpose of this management plan is to consolidate relevant information about Allapattah Flats, including goals and objectives, past and present land uses, resource inventories, and management needs to guide the management program for the period 2004 - 2008. Management activities described in this plan are based on legislative mandates, established District policies, and requirements and recommendations of the NRCS Wetland Reserve Program and Indian River Lagoon South Feasibility Study.

The Land Stewardship Program's (LSP) mission is to provide natural resource protection and management while allowing appropriate recreational use on designated public lands. This mission statement together with requirements set forth in Florida Statutes 373.139 and 373.1391, provide three primary land management goals:

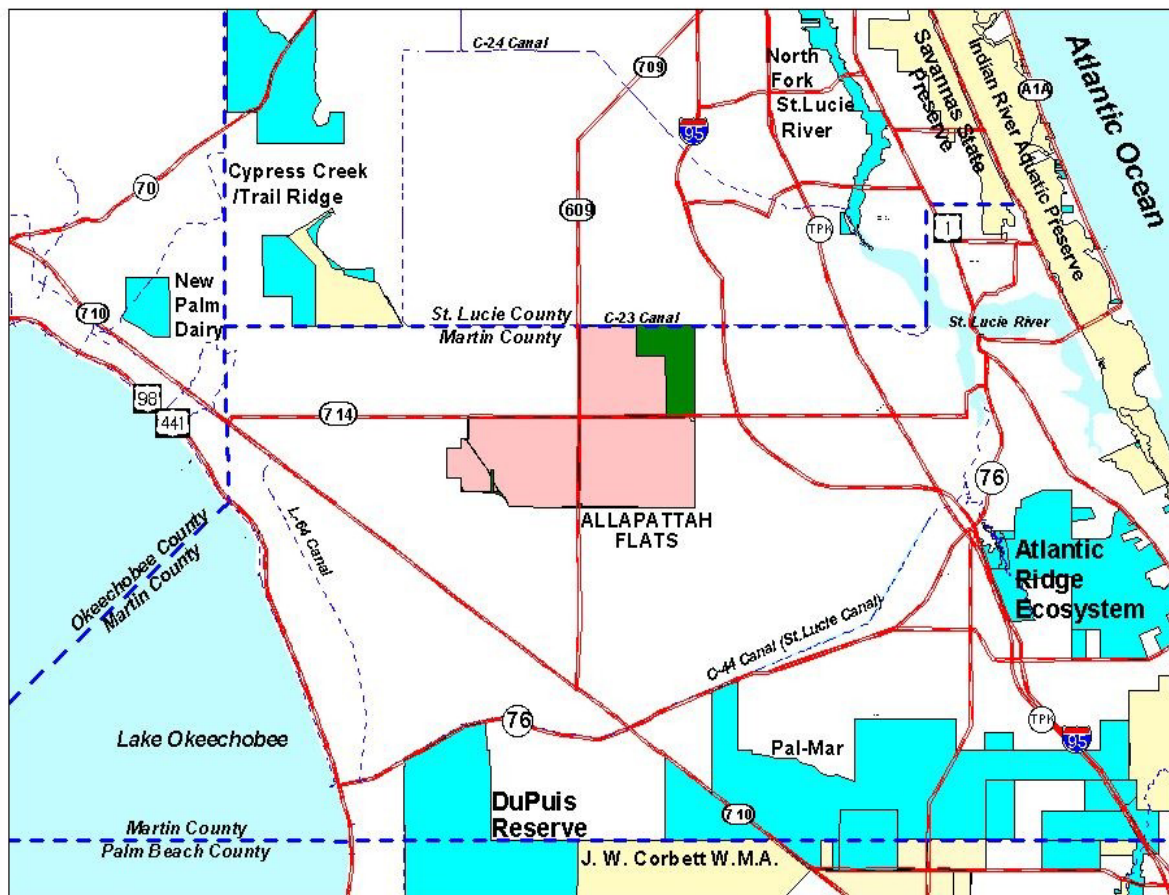
- Conserve and protect water resources
- Protect and/or restore land to its natural state and condition
- Provide compatible public use

To accomplish these goals, the LSP performs six major land management functions:

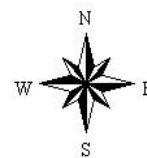
- Strategic, project, and management planning
- Operation and maintenance of land resources
- Development of public use programs
- Development of restoration projects
- Evaluation of management activities
- Administration of land management service contracts

Natural resource management on Allapattah Flats includes the restoration and maintenance of natural vegetative communities, wildlife management and the protection of rare, threatened and endangered species. Habitat restoration, prescribed burning, vegetation management and forest management will be used to preserve, protect, and enhance the natural resources that are found on the site. An aggressive exotic plant management program will be implemented.

This management plan will consolidate information regarding the goals and objectives for Allapattah, as well as information regarding past and present land uses, resource data, restoration and management needs, and potential public use programs.

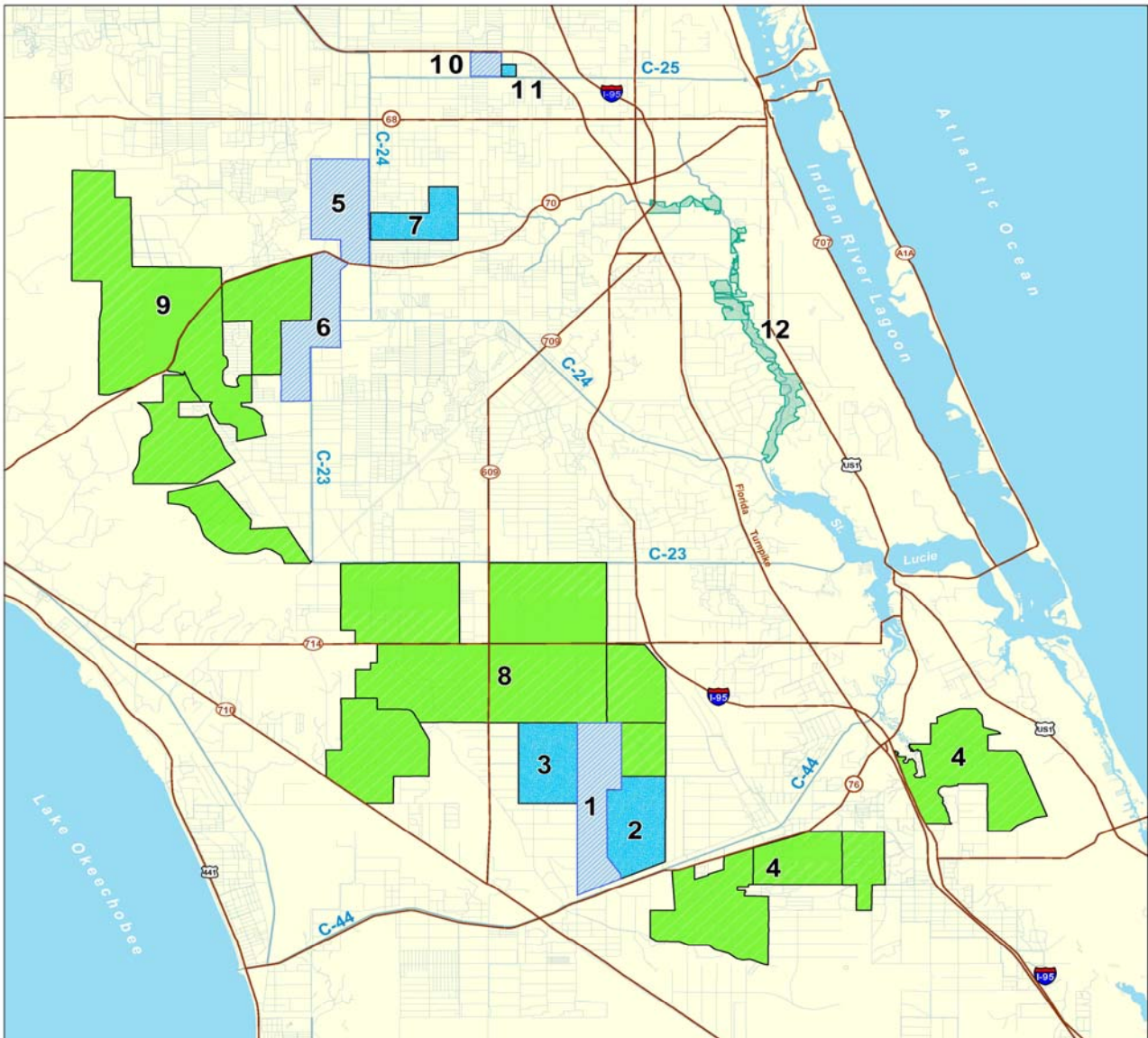


- Major Road
- District Boundary
- County Lines
- SFWMD Canals
- SOR Lands Acquired
- Potential Acquisition Areas
- Other SOR Project Areas
- Other Conservation Lands
- Water Bodies



Allapattah Flats Location Map

Figure 1



Indian River Lagoon South Recommended Plan

C-44 Basin Components

- 1 C-44 - Reservoir
- 2 C-44 - Stormwater Treatment Area
- 3 C-23/C-44 - Stormwater Treatment Area
- 4 Palmar Complex - Natural Storage and Water Quality Area

- Natural Floodplain Restoration
- Natural Storage and Water Quality Area
- Reservoir
- Stormwater Treatment Area

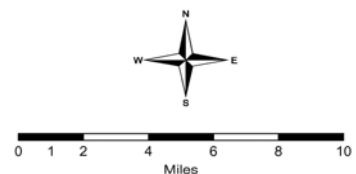
C-23/24 Basin Components

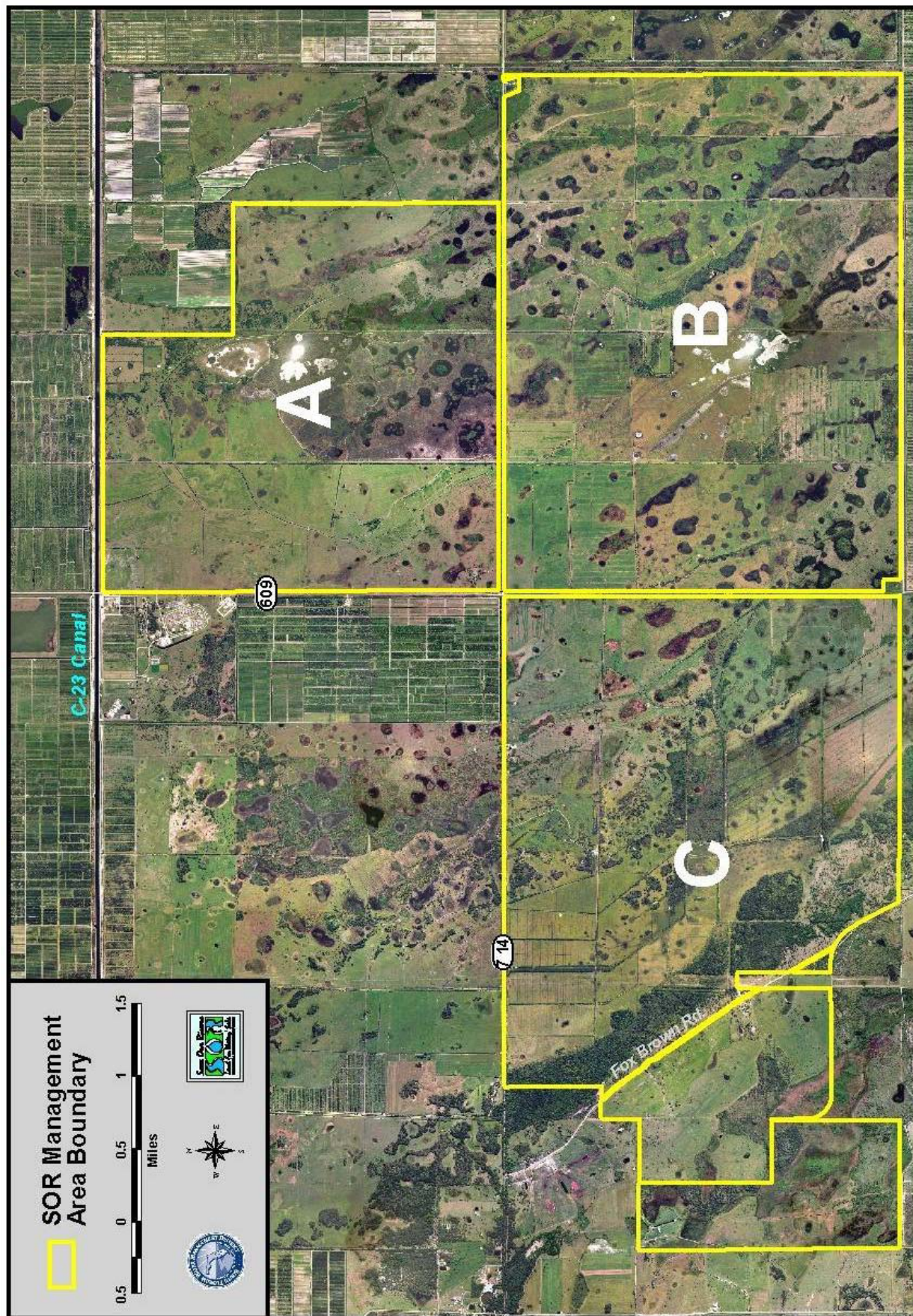
- 3 C-23/C-44 - Stormwater Treatment Area
- 5 C-23/C-24 - North Reservoir
- 6 C-23/C-24 - South Reservoir
- 7 C-23/C-24 - Stormwater Treatment Area
- 8 Allapattah - Complex Natural Storage and Water Quality Area
- 9 Cypress Creek/Trail Ridge Complex - Natural Storage and Water Quality Area

C-25, Northfork and Southfork Basin Components

- 10 C-25 - Reservoir
- 11 C-25 - Stormwater Treatment Area
- 12 Northfork Natural Floodplain Restoration
- 13 Muck Remediation and Artificial Habitat

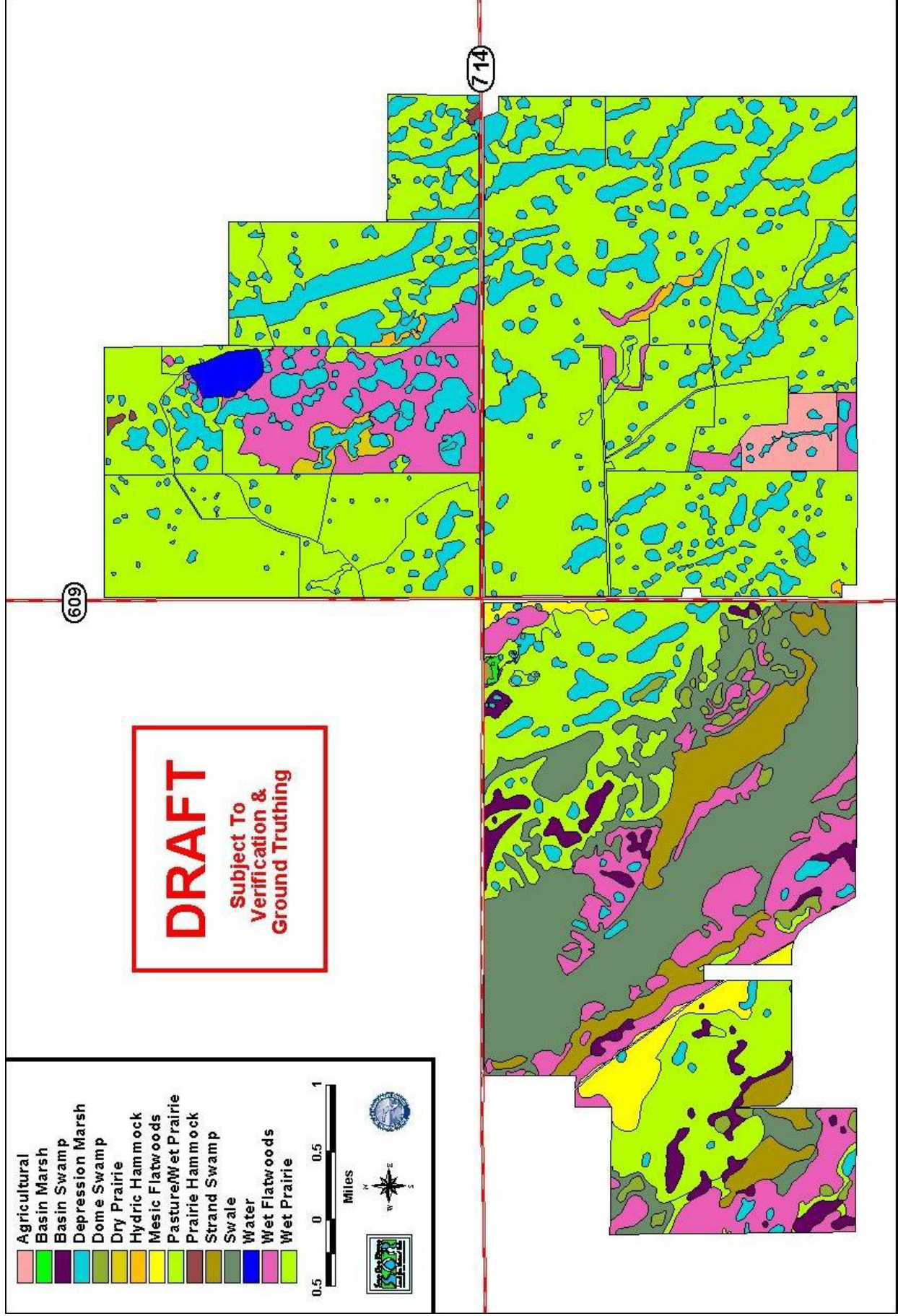
Figure 2





Allapattah Flats Management Area
 (With 2003 2 Foot True Color Satellite Imagery)

Figure 3



Allapattah Flats Natural Communities
(Converted From NRCS to FNAI Classification)

Figure 4

2.1 Project-wide Goals & Objectives

Goal 1: Restore upland and wetland components in accordance with the Indian River Lagoon Initiative of the Comprehensive Everglades Restoration Plan and the Wetlands Reserve Program agreement between the District/Martin County and Natural Resources Conservation Service

Objectives:

- Use habitat restoration to improve basin storage resulting in stage-storage hydrographs more representative of pre-development hydrologic conditions
- Reduce nutrient loading in the St. Lucie Estuary and Indian River Lagoon through natural retention of stormwater and reduced discharges
- Provide ecological conditions suitable for habitat expansion and intensified wildlife utilization

Goal 2: Manage natural communities and modified habitats to protect and enhance water, floral, and faunal resources

Objectives:

- Implement an aggressive, integrated exotic plant management program. All treatments are to be coordinated with the restoration activities and documented
- Implement a prescribed burning program that is appropriate to on-site community burn regimes

Goal 3: Implement an interim resource based public use program

Objectives:

- Develop a low impact, passive public use program that is consistent with project restoration objectives and the major ideas expressed at the July 2, 2003 Allapattah Public Use Advisory Group meeting
- Develop trails, access points, and parking facilities that spatially separate equestrian users from hikers and bicyclists that are in compliance with the Wetlands Reserve Program conservation easement; Comprehensive Everglades Restoration Plan; and South Florida Water Management District and Martin County guiding principles

Goal 4: Complete a management lease between the District, Martin County, and Florida Fish and Wildlife Conservation Commission (FWC) that establishes FWC as the long-term manager of the property

3.0 Resource Inventory & Monitoring

Vegetation and vertebrate species will be inventoried and natural communities mapped by an interagency team. The monitoring template is included as Appendix C. These data will be made available to land managers for planning purposes. A cultural resources survey will be completed for the property and any archeological or historic sites that are considered significant will be inventoried by contract archeologists.

Floral and faunal inventories that have been completed to date are included as Appendix D, and will be updated regularly.

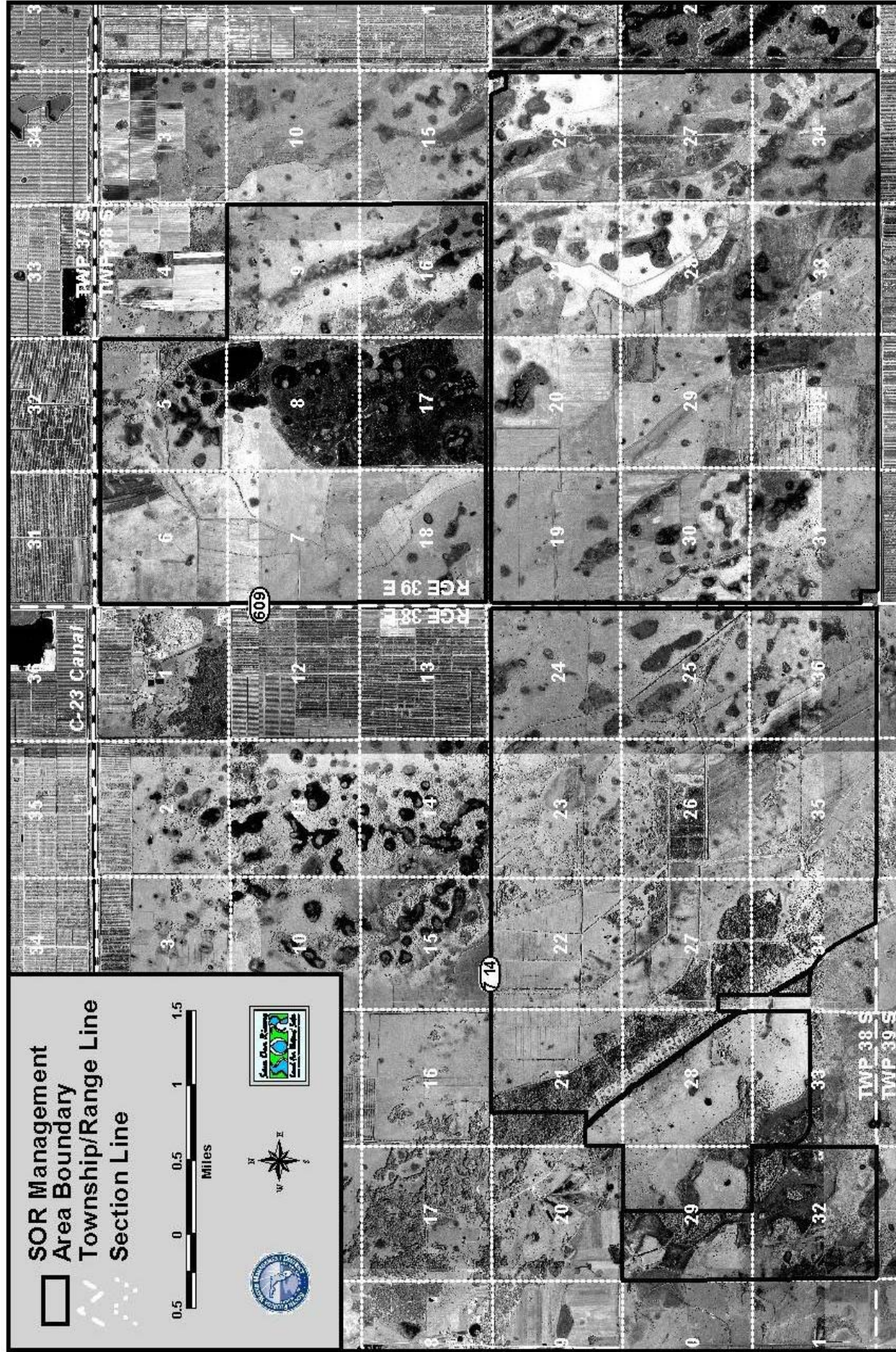
3.1 Hydrology

This hydrographic region, which historically extended from St. Lucie County to southern Martin County along a northwest to southeast drainageway, was known as Allapattah Flats. Topographic relief throughout the region is minimal, and across the project area varies north to south from 29.0' to 27.5' NAVD. Ground elevations in the deepest depression wetlands are approximately 23' NAVD. Allapattah Flats was a large bowl that was contained by the Osceola Ridge on the west side (approximately where Fox Brown Road is located today) and the Green Ridge (I-95 corridor) to the east. The portion of the property west of Fox Brown Road drained to Lake Okeechobee, while the remainder of the site drained southeast toward the St. Lucie Canal. Allapattah Flats was dominated by a series of depression/basin marshes and wet prairies that paralleled the direction of flow.

Approximately 50% of the property east of CR 609 (11,000 acres) contains hydric soils and historically was wetland. Engineering and modeling analysis indicate that the appropriate wet season water elevation (post-restoration) in the wetlands should be approximately 27.3'. West of CR 609 nearly 85% of the soils are described as hydric. Additional modeling efforts will be necessary to assess appropriate water depths in this area.

The management area has been severely over-drained by a series of ditches and swales that were excavated over the years to improve agricultural productivity. Three major north/south canals are located along section lines and drain to the C-23 canal (Figure 5). An extensive network of shallow swales and ditches were dug in conjunction with agricultural activities that drain nearly all 11,000 acres of wetlands and lowered the water table over the rest of the property. The management area is also bisected by two county roads, CR 609 and CR 714, which have significantly affected sheetflow across the property. Two Florida Power and Light transmission lines traverse the property north to south. The easternmost line was constructed along a canal berm one mile east of SR 609 and has no hydrologic impact. The second line crosses the slough in the southwest part of the management area, between Sections 21 and 22.

A 120 ac. depression marsh at the north end of Cottage Road in Sections 5 and 8 has been surrounded by a perimeter ditch/dike since the late 1950s. Prior to purchase of the property this wetland was connected to the C-23 canal by a ditch/pump which brought water to the marsh for water storage/irrigation purposes.



Allapattah Flats Management Area

(With 2000 1 Meter Resolution Digital Orthophotography Quarter Quadrangles)
Figure 5

There are indications that some portions of the management area have been subject to continuous sod removal and have decreased slightly in elevation. With hydrologic restoration these areas may develop more wetland character than they would have historically.

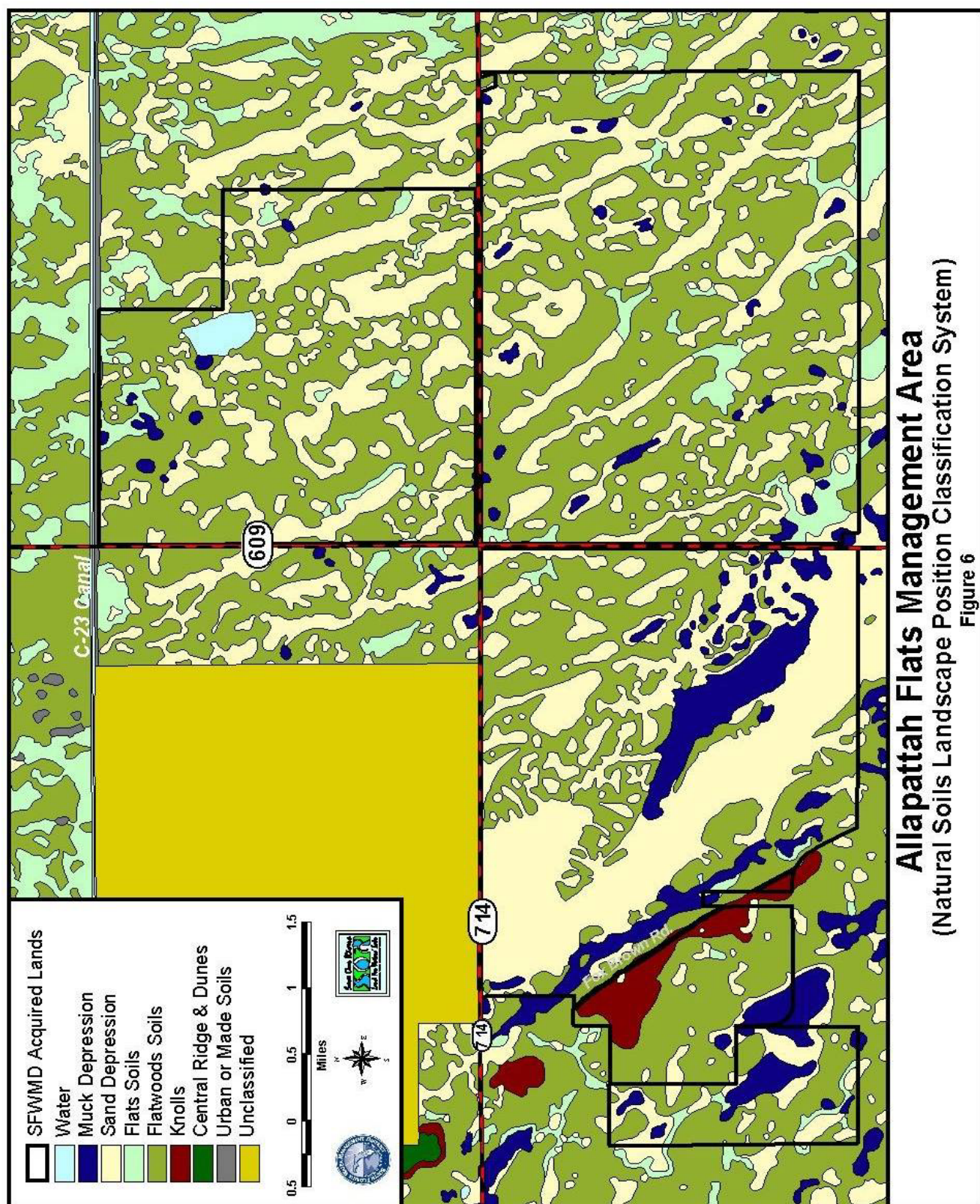
3.2 Soils

Four categories of soils, as consolidated by the Natural Soil Landscape Position (NSLP) soil classification systems developed by NRCS in conjunction with the SFWMD, are present on Allapattah (Figure 6). These include flatwood, flats, sand depression and muck depression soils. The NSLP reclassified 909 soil map units into 12 categories based on the depth of the seasonal high water table, soil morphological characteristics and geographical location. Community descriptions are those defined using the Florida Natural Areas Inventory (FNAI) classification system.

Flats soils – Flats soils are poorly drained hydric soils. Flats are located between flatwood and depressional landscapes and are generally regarded as transition areas. The seasonal high water table can typically range from the soil surface to one foot below the surface for 4-9 months during the wet season (June – September) Examples of these soils include that are present on Allapattah include Riviera and Pineda. These soils are generally long, narrow areas that serve as drainage ways between depressional soils during periods of heavy and prolonged rainfall. A typical ecological community associated with flats soils would be the wet prairie, generally characterized by open expanses of grasses, sedges and rushes, and may include sparse pine coverage. Fire and artificial water fluctuations are major factors affecting these areas, and variations in the natural sequences of either event can change the diversity and productivity of these communities.

Flatwoods soils – Flatwoods soils are poorly drained, non-hydric upland soils. Most of the soils in this series have a subsurface spodic horizon (hardpan). The seasonal high water table can range from ½ to 1 ½ feet below the soil surface for 3-6 months annually, with some areas becoming inundated for short periods during the wet season or during large storm events. Examples of these soils on Allapattah include Wabasso and Oldsmar. Typical vegetative communities on flatwoods soils include dry prairie, wet and mesic flatwoods, and prairie hammock. The landscape position of these soils affects plant-water relationships and causes slight differences in plant composition from wetter to drier areas. Natural vegetation typically consists of scattered slash pine with an understory of saw palmetto and grasses. Some areas are dominated by wire grass and broomsedge and have few, if any trees. Other areas are characterized by gallberry, shiny blueberry, tarflower, and wax myrtle.

Sand Depression Soils – The sand depression landscape position includes hydric soils that are very poorly drained. Often these areas are depressions adjacent to and within flatwoods communities and flats landscapes. The seasonal high water table can range from one foot below to two feet or more above the soil surface for 7-10 months annually. Examples of these soils that are present on Allapattah include Riviera, Wabasso, and Oldsmar depressional.



Wetlands dominate this landscape. Natural communities include swale and depression marsh. Vegetation can vary widely, but typically includes pickerelweed, maidencane, or sawgrass, and may also contain spike rush, beak rush, fire flag, or arrowhead.

Muck Depression Soils – Muck depression soils are very poorly drained hydric soils that have an organic surface layer underlain by sandy marine sediments. Muck depressions often lie adjacent to flats and flatwoods landscapes. The seasonal high water table can range from six inches below the surface to two feet or more above the surface for 7-11 months annually. An example of this type of soil present on Allapattah is Gator.

Several biological communities may be found on this landscape, including basin and depression marsh, baygall, and dome swamp. Local conditions favor one community over the other, with fire frequency and site hydrology playing a large role in the distribution.

3.2.1 Soil Contamination Sites

Phase 1 and Phase II Environmental Site Assessments have been conducted to determine the presence or absence of contamination from petroleum storage and use, oil exploration activities, sportsman activities, pesticide and herbicide storage and use and application of municipal waste on the Allapattah property. From March 3-11, 2003 soil excavations were conducted on Parcels A and B at six 5-acre sub-grid locations where elevated concentrations of pesticides presented a potential risk. In addition, three areas of petroleum impacted soil were excavated at two former pump stations and at the location of a former tracked vehicle. A total of 308 tons of pesticide and petroleum impacted soils were excavated for disposal at the Okeechobee landfill as non-hazardous waste. The environmental assessment on Parcel C also resulted in a number of recommendations for debris removal (4 subsurface debris areas), excavation, transportation, and disposal of pesticide impacted and stained soil from the interior of the chemical mix/storage barn, delineation, excavation, transportation and disposal of toxaphene contaminated soils, and metals contaminated soils in a number of locations. Follow-up on these recommendations was completed in early 2004. Closure assessments consisting of soil and groundwater sampling were completed and multiple areas of miscellaneous solid waste were removed (*Phase I and II Environmental Site Assessment* – 4 volumes and *Corrective Actions Assessment Report-1* volume)).

3.3 Natural Communities

Allapattah Flats Management Area is a relatively disturbed expanse of improved pasture (bahia, limpo, and rhodes grass) that includes some remaining stands of south Florida slash pine (Sections 8, 16, 17), depression marsh, and wet prairie communities. A fairly significant strand system is located on the west side of the property near Fox Brown Road that is comprised primarily of hardwood wetland species (red maple, swamp tupelo, water oak). Habitat conditions vary widely, though most areas have been severely impacted by past drainage and agricultural activities. A vegetation assessment for parcels A and B was initiated in 2002 in association with the continuation of grazing leases. An additional assessment has been initiated for Parcel C

(Figure 4). Additional work will be completed with functional assessments of the existing on site wetland and upland communities as restoration activities progress. It is also anticipated that periodic assessments of pasture quality will be assessed to determine and adjust the appropriate density and rotation of grazing animals. Wetland community assessments, using WRAP (Wetland Rapid Assessment Procedure), were completed in 2003 and 2004 and will be reassessed during restoration.

3.4 Wildlife

Initial wildlife inventories are currently being conducted for the Allapattah property in association with other site activities. (Appendix D). Species lists have been compiled and will be frequently updated as new species are observed. The property has been identified by USFWS and FWC as important habitat to rare and endangered species, including sandhill crane, wood stork, crested caracara, bald eagle, indigo snake, Florida pine snake, gopher frog, and numerous wading birds and raptors. With significant restoration, the property could potentially benefit and become important to the recovery of both the Florida panther and whooping crane.

3.5 Cultural Resources

Policy 05.00113.10. Archeological and historic resources are protected by site identification and interagency coordination with the Florida Division of Historical Resources (FDHR). Land management planning shall include an analysis of archeological data accompanied by appropriate public education opportunities.

As a state agency responsible for management of publicly owned lands, the District is required to preserve historical and cultural resources located on District land. Additionally, as a federally sponsored CERP and WRP project, Section 106 of the National Historic Preservation Act is also applicable.

Goal: historic preservation by identification, evaluation, documentation, protection and stabilization of known historic or prehistoric sites.

- A cultural resources survey completed for Martin County in the mid 1990s indicates that a portion of Allapattah is considered an archeological zone. There are several named archeological sites known to exist on the property and three buildings have been designated as being of local historic interest
- Corps of Engineers has completed a preliminary review of 1940s photography to identify potential cultural resource sites and will conduct a more thorough examination of the property to determine the presence or absence of additional sites
- During an initial survey completed in July 2003 by the Corps of Engineer's archeologist, two previously uncatalogued black dirt midden sites were identified

The District, in cooperation with the Corps and the State Historical Preservation Office, will maintain a database of all known archeological and historical sites on the property and plan management activities, particularly those that are invasive or ground disturbing, to avoid impact to these areas.

4.0 Natural Resource Management

Policy 05.0011. The Land Stewardship Program mission is to provide natural resource management and protection while allowing appropriate recreational use on designated public lands.

Natural resource management responsibilities of the District are defined by statute and by the District's land stewardship policy. Many properties owned and managed by the District contain natural communities whose structure and function have been altered by previous land uses. The District manages and maintains these lands in an environmentally acceptable manner and, to the extent practicable, restores them to a more natural state and condition. On Allapattah property this will be accomplished in conjunction with the WRP and CERP project guidelines. At a minimum, natural resource management will include an aggressive program of habitat restoration, exotic plant control, and prescribed burning.

4.1 Habitat Restoration

Policy 05.00111. The basis for the Land Stewardship Program is the protection and management of natural hydrologic resources.

Policy 05.0011.3. Where feasible, an attempt shall be made to restore a more natural hydroperiod on tracts where the drainage patterns have been altered.

Severe overdrainage occurred from a network of agricultural drainage ditches and swales that were built to facilitate the drainage of water north to the C-23 canal. A detailed site restoration plan for Allapattah has been developed under an agreement with the Natural Resources Conservation Service Wetland Reserve Program. The restoration plan for the areas east of CR 609 is included as Appendix A. Although additional modeling and assessments will be necessary, restoration activities for Parcel C and the Steele property will be similar to Parcels A & B. The major components of the plan include:

- Filling all secondary drainage ditches and swales to natural ground elevation
- Construction of a perimeter earthen berm to elevation 29.0' NAVD (where needed) Installation of operable water control structures on the 3 north-south canals where they discharge to C-23 canal
 - Canals will remain open and functional during major storm events, but water control structures will hold water levels higher and reduce groundwater impacts to wetlands
- An aggressive program to chemically and mechanically treat exotic vegetation
 - *Lygodium* was initially targeted for treatment over the entire 21,000 ac. management area

- Treatment of other exotic species will be done in conjunction with phased restoration construction
- Prescribed burning at intervals appropriate for the various natural communities
- Roller chopping and mowing to reduce and control nuisance shrubs
- Reforestation of selected areas—planted areas will be temporarily removed from cattle grazing until trees become sufficiently established

4.1.1 Restoration Monitoring

An overall monitoring plan will be implemented to address the efficacy of achieving the restoration and management objectives that have been established for the Allapattah Flats property as a component of the Indian River Lagoon Feasibility Study. The monitoring plan will generate the types and frequencies of data necessary to adequately evaluate the following factors:

- Quantity of water retained
- Quality of water retained
- Quantity of water discharged
- Quality of water discharged
- Timing of water discharged
- Ecosystem response to changes in hydroperiod depth and duration
 - increase in spatial extent of wetlands
 - increase in habitat value for fish and wildlife

Monitoring Goals

Goal 1: Reduce basin runoff via on-site retention of water

Restoration factor: Quantity of Water Retained

Monitoring measures

- Rainfall
- Surface water extent
- Depth
- Evapotranspiration

Restoration factor: Quantity of water discharged

Monitoring measures

- Surface flow from the property
- Compare current to restored hydrograph

Goal 2: Reduce nutrient loads to downstream water bodies, including St. Lucie Estuary

Restoration factor: Quality of Water Retained

Monitoring measures

- Sample twice monthly at three internal marshes for nutrients
- Annual collection of fish tissue for total mercury and organochlorine pesticides
- Composite sediment sampling if fish tissue concentrations exceed criteria

in mercury monitoring CERP guidance memo

Restoration factor: Quality of Water Discharged (to determine nutrient reduction trends)

Monitoring measures

- Flow weighted samples, twice monthly, 2 discharge locations, nutrients
- Grab samples, twice monthly, 2 discharge locations, nutrients
- Groundwater loss modeling by Corps of Engineers

4.2 Vegetation Management

Policy 05.00112.4. *Where practicable, an attempt shall be made to restore and maintain desirable vegetation to promote habitat diversity in areas where exotic/invasive vegetation or improved land uses have substantially altered the historic landscape.*

Policy 05.00113.12. *Mechanical equipment may be used in conjunction with prescribed burning and other management tools to control vegetation and restore habitat structure.*

Historically, Allapattah Flats was dominated by wet flatwoods that were open landscapes of south Florida slash pine with low shrub vegetation and herbaceous ground cover, interspersed with numerous wet prairies and depression marshes. In addition, the western portion of the property included linear strand swamp communities. These landscapes were maintained by seasonal flooding and frequent natural fires. Over much of the site logging and understory clearing for pasture improvement has eliminated the historic pine flatwood community. In the remaining forested areas, over-drainage and fire suppression have resulted in dense stands of nuisance shrubs, particularly wax myrtle. Exotic species, including Brazilian pepper, Old-world climbing fern, Chinese tallow and cogon grass are common throughout the site.

A combination of roller chopping, shredding, and chemical application will be used to control and reduce the coverage of nuisance shrubs and exotics through the use of Land Stewardship Program field technicians and contractors.

4.2.1 Exotic/Invasive Plants

Policy 05.001122.3. *Management practices will strive to identify existing infestations of exotic/invasive plants and implement appropriate control or eradication measures.*

Policy 05.00113.2. *Exotic plant control in all management areas shall attain a level of success where periodic maintenance eliminates the infestation or reduces the spread of exotic plants.*

South Florida's subtropical climate provides an excellent growth environment for the rapid spread of exotic plants. Over-drainage, extensive hydroperiod alterations and physically disturbed areas also contribute to the same rapid spread of invasive plants. Exotic plants themselves can cause extensive alterations to an area's natural ecosystems through the partial or total displacement of native plants, loss of wildlife habitat and degradation of public use areas.

A number of exotic invasive species have been noted on Allapattah. By far the most abundant species is Brazilian pepper, which is present along most of the site's drainage ditches and fence lines, in addition to being dispersed throughout the property. The exotic that causes the greatest concern, however, is Old World climbing fern, which is extremely persistent and difficult to control. Lygodium is present in the remaining natural forested communities, particularly the bayheads that are scattered throughout, and in the strand swamp on the western side of the property.

All Category I and II non-native plant species as identified on the Exotic Pest Plant Council's (EPPC) will be targeted for control. Category I species include non-native plants that invade and disrupt Florida's native plant communities. Category II species have the potential to invade and disrupt natural successional processes. Both Category I and II species are considered invasive and a threat to the function and ecological stability of Florida's natural communities. Other exotic species that have been noted on Allapattah include Melaleuca, guava, cattail, cogon grass, torpedo grass, Chinese tallow, and tropical soda apple.

Invasive exotic plant control measures for Allapattah will include a combination of herbicide applications, prescribed fire, roller chopping, mowing and physical removal. Selection of control measures will be based upon species type, degree of infestation, environmental factors and potential to impact natural communities. Private contractors under the direction of the District's Vegetation Management Division will conduct the exotic plant control activities. New methodologies to reduce bahia and other pasture grasses will also be explored as the restoration of the property progresses. General treatment methodology is outlined in Table 1.

Plant	Method	Herbicide(s)/Rates	Timing
Melaleuca (mature)	Aerial spray (helicopter)	Arsenal--3qts/ac. mixed w/gly* @3qts/ac.	Late winter-early spring
Melaleuca (mature)	Frill & girdle or cut stump	Frill and girdle: Arsenal--25% mixed w/gly* @25%, no surfactant. Cut stump—gly* @10%	Year round
Melaleuca (saplings)	Cut saplings & apply herbicide to stump or use backpack sprayer	Cut saplings--Arsenal @ 25% mixed w/gly* @10% Backpack,--3% Arsenal mixed w/3% gly* w/surfactant	Year round
Melaleuca (seedlings)	Hand-pull	Same as backpack spray on saplings	Year round
B. pepper (mature)	Aerial spray (helicopter)	Garlon 3A--2-3 gal. mixed w/1/2-1 qt. Arsenal	Year round
B. pepper (mature)	Foliar spray "lacing"	Arsenal--1 qt. mixed w/1 pt. Garlon 3A	Year round
B. pepper (mature)	Basal application	Garlon 4 @10% mixed w/Stalker @3%	Year round
Lygodium	"Poodle cut" & herbicide	Full label rate of gly* or Escort—1-2 oz.	Year round (not during cold spells)
Cogon grass/torpedograss	Foliar spray	Arsenal--1 qt. mixed w/full label rate of gly*	Year round

*gly—Glyphosate product

Table 1 Exotic species control methodology

4.2.2 Rare, Threatened and Endangered Species (plants)

Policy 05.00112.2. Particular emphasis shall be placed on the identification, protection and management of rare, threatened and endangered species.

Listed species are those plants and animals considered rare within a specific geographic area by the U.S. Fish and Wildlife Service, the Florida Fish and Wildlife Conservation Commission (FWC), the Florida Natural Areas Inventory (FNAI), and the Florida Department of Agriculture and Consumer Services (DACS). A list of these species is updated annually and published by FWC. Table 2 identifies the listed plants found to date on Allapattah. Prior to any management or restoration activities involving soil disturbance the areas will be inventoried for listed species.

Common name	Scientific name	Designation
Pine lily	<i>Lilium catesbaei</i>	Threatened
Leather fern	<i>Acrostichum danaeifolium</i>	Commercially exploited
Royal fern	<i>Osmunda regalis</i>	Commercially exploit
Cinnamon fern	<i>Osmunda cinnomomea</i>	Commercially exploit
Wild pine	<i>Tillandsia utriculata</i>	Endangered
Wild pine	<i>Tillandsia fasciculata</i>	Endangered

Table 2 Listed plant species found on Allapattah

Appropriate fire and hydrologic regimes, and control of invasive exotics in natural communities will be established with the intent of perpetuating listed plant species. District public use rules aid in the protection of native habitat and specifically prohibit destroying, defacing or removing any natural feature or native plan on District lands (40E-7.537 General Prohibitions). These policies and management actions give lawful protection and provide environmental conditions suitable for their growth and protection.

The exotic Mexican weevil, *Metamasium callizona*, has been noted within some areas of the Allapattah property. Two species of once abundant bromeliads, *Tillandsia utriculata* and *Tillandsia fasciculata* have been placed on the state's list of endangered plant species as a direct result of this weevil. A number of other bromeliad species are also under attack. The presence of this weevil will be noted to assist the Florida Council of Bromeliad Society's efforts to control it. If needed, the District will assist in the collection of seeds for off-site germination.

4.2.3 Forest Management

Policy 05.00113.8. Sustainable use of forest resources shall be conducted where these activities adhere to a series of environmental criteria that meet the Land Stewardship Program goals. Timber contractors will be required to meet silvicultural best management practices (BMPs) developed for Florida forests.

Policy 05.00113.6c. *Timber sales will be conducted to improve forest health or support specific forest management goals.*

Many District properties are designated multiple use, thus renewable resource utilization, including timber harvesting, is considered a viable land management option. Resource utilization must be compatible with CERP, Wetland Reserve Program, and Land Stewardship Program criteria, goals, and objectives.

Much of the upland forest structure of Allapattah has been compromised with previous logging and agricultural use. Most of the property has been converted to improved pasture, though a few areas of wet and mesic flatwoods remain. Additionally, a fairly significant strand swamp (red maple, water oak, tupelo) is located on the western side of the property east of Fox Brown Road. As the restoration progresses attention will be given to restoring the form, function, and structure of forested communities, as well as the herbaceous wetland communities. Several methods for understory restoration will be attempted on a limited basis, as there currently is no affordable method for effectively achieving this kind of restoration on such a large scale. One of the biggest obstacles to restoring understory and ground cover species in former pastures is competition from non-native grasses, particularly bahia. Bahia forms a very dense sod making it difficult for native species to become established. Planting pine seedlings at high densities—600-700/acre may stress bahia by shading as the tree canopy closes in 8-12 years. There is speculation that shading alone may allow understory and ground cover species to establish, or kill it with limited applications of herbicide.

In March 2004 the District began its first reforestation efforts at Allapattah and planted 125,000 bare root pine seedlings over 275 acres. An additional 250,000 seedlings have been ordered and should be available for planting in early 2005. Site preparation through scalping or herbiciding of existing vegetation will be considered to increase seedling survival.

4.2.4 Range Management

Policy 05.00113.9. *Range management and grazing will be considered on improved or native ranges when the introduction of cattle will not conflict with other natural resource management and public use goals.*

Prior to acquisition, the property was managed as Allapattah Ranch, with livestock (cattle) grazing as the primary land use. The District and Martin County have executed a private lease agreement that allows continued grazing of the property as a management tool. A grazing plan has been developed by the Natural Resources Conservation Service for Parcels A and B (east of CR 609) and eastern Parcel C. The grazing plan objectives are to improve or maintain an optimum level of the native forages and assist in the reduction of biomass. Improving existing forages is **not** a goal for this project. There will be an emphasis on maintaining a balance to ensure a desirable stand of forage while limiting grazing in wetlands. The grazing plan allows that as wetlands are restored there will be a gradual reduction in the number of animal units. Areas that have been disturbed and planted with native vegetation shall be

deferred from grazing for a minimum of one complete growing season or until native grasses and other herbaceous species are well established and produce seed. Reforested areas will be removed from active grazing for a minimum of three years. It is anticipated that the property will be frequently reassessed to ensure that grazing continues to be compatible with the restoration goals and objectives. The grazing plans are attached as Appendix B.

4.2.5 Fire Management

Policy 05.00113.3. Prescribed fire is a primary management tool on District lands and will be applied within fire maintained communities at appropriate intervals.

Most of the natural communities found in south Florida rely on frequent fire to maintain their vegetative characteristics and biodiversity. Wildfires no longer occur with historic frequency or extent, resulting in an alteration of natural community structure and function. Prescribed fire attempts to mimic the benefits of natural wildfires that historically provided for the reduction of fuel loads, recycling of soil nutrients, and maintaining natural communities by inhibiting hardwood encroachment and stimulating fire-adapted plant growth. The benefits of prescribed fire are well recognized and will be one of the primary land management tools. All areas proposed for new fire lines will be inventoried for listed species prior to cutting lines.

4.2.6 Fire History

Limited fire history information is available for the property prior to its purchase in 2002-2003. Over the years most of the forested portions of the property have been converted to improved pasture. Regular burning of pastures occurred to improve forage.

4.2.7 Prescribed Burning

District land stewardship policy calls for a fire management plan to be developed for each management area. Plans include a description of location and natural community types, fire history, fire management objectives for each plant community, fire constraints, and a burn prescription. The Land Stewardship Program bases all fire management plans on ecological research and professional experience. Fire frequency schedules for each natural community consider recommendations provided in *The Natural Communities of Florida* (FNAI, 1990). To mimic historic fire conditions, the District emphasizes growing or lightning season burns where practical. Natural firebreaks are utilized where possible to promote historic fire patterns, avoid soil disturbance, and reduce hydrologic flow disruption created by fire lines. Listed species life requirements and welfare are elements of prescribed fire planning. Application of fire, with appropriately timed herbicide treatments, is utilized as a tool for control of invasive plants and is judiciously applied where fire-adapted exotics are present. Prescribed fire planning is critical when dealing with fire adapted exotic species such as *Melaleuca* and Old World climbing fern.

Burns are executed using proven safety measures as defined by the Prescribed Burning Act of 1990, 590.026 F.S. This legislation and associated administrative rules outlines accepted forestry burn practices and is administered through the Florida Division of

Forestry (DOF). The District has a five man prescribed fire crew (Land Stewardship Field Crew) and may utilize other District staff or cooperating agency staff, such as DOF and FWC to conduct burns. All Land Stewardship Program staff have completed the state certified burn course to ensure fire safety and burning efficiency.

Allapattah will be divided into management units, utilizing natural firebreaks where possible. Internal fencing will be modified to facilitate the establishment of management units. Prescribed fire will be applied at appropriate fire intervals for each natural community. Historically, much of Allapattah consisted of pine flatwoods interspersed with wet prairie and depression marshes, bayheads, and mesic hammocks. Subsequently, much of the property has been converted to improved pasture and is only lightly forested. The management units identified as Cottage Rough and Cottage Road are still relatively natural pine flatwoods. Approximately 1,000 acres of the Cattle Rough unit were burned in March 2003. The District will strive to maintain an approximate 3-year burn frequency in these and other restored flatwoods. Prescribed burning will be used in some areas immediately prior to hydrologic restoration efforts to reduce excess vegetation in wetlands that have become overgrown with nuisance shrubs. Whenever possible, large, aerial burns will be used to reduce the amount of burn preparation, the number of disked fire lines, manpower needs, and the cost that is associated with small burns. As restoration progresses and the land begins to recover to support more ecologically complete communities, burning schedules will be developed to support the natural burn regime of those communities.

4.2.8 Wildfire Suppression

Policy 05.00113.4. *The Division of Forestry will be notified of all wildfires on District lands. The District's Land Stewardship Program will provide initial suppression when commensurate personnel and equipment are available.*

Wildfires ignited by lightning are a common occurrence throughout Florida. It is District policy and state law that the Division of Forestry (DOF) be notified when a wildfire occurs on District properties. DOF has been provided maps of Allapattah to assist them in response to a wildfire should it become necessary. The Land Stewardship field crew will respond to, and if appropriate, begin suppression of area wildfires when detected during working hours. If possible, a fire assessment will be made before calling DOF.

If District manpower is available, and other conditions are favorable, a permit will be requested from DOF to incorporate wildfire into a controlled burn. Although infrequent, allowing these wildfires to burn will help achieve needed burn totals and will prevent counterproductive and unnecessary suppression efforts. It is recognized that the best wildfire mitigation is to maintain the area with frequent prescribed fires to promote a healthy open forest with light fuel loads.

4.3 Wildlife Management

One of the primary objectives in the management Allapattah is to maintain healthy fish and wildlife populations. This will be accomplished in a number of ways:

- Performing land management activities that maintain and/or improve

native wildlife habitat

- Conducting specific management beneficial to protected species
- Monitoring wildlife management activities
- Following management guidelines for listed species protection, as determined by the *Multispecies Recovery Plan for Threatened and Endangered Species of South Florida, Volume 1* (U.S. Fish and Wildlife Service, 1999) <http://southeast.fws.gov/vbpdfs/execsum.pdf>
- Reducing non-native pest species populations where appropriate
- Maintaining a master file of confirmed and potential wildlife species
- Cooperating with the Florida Fish and Wildlife Conservation Commission (FWC) on wildlife management issues

Wildlife management on Allapattah will be directed toward production of natural species diversity consistent with the biological communities that are present. It is anticipated that early efforts will be concentrated on the management of wildlife, since Allapattah has minimal deep water habitat to support a year round fishery.

4.3.1 Game Management

Policy 05.00114.2d. Hunting, in areas opened for such use, is governed by FWC regulations.

Allapattah, despite its currently impacted state, supports a number of game species. The three most common are white-tailed deer, feral hog, and wild turkey. Small game includes quail, dove, rabbit, snipe, and gray squirrel.

Public hunting on District lands is conducted under an agreement with the Fish and Wildlife Conservation Commission. The District is currently discussing management of the fish and wildlife resources, including hunting, with FWC, and anticipates Allapattah will be open for small game hunting during the 2004-2005 season, deer and turkey hunting to follow in 2005-2006. The Commission will be responsible for the regulation of public hunts and the enforcement of all wildlife resource related rules and regulations. Such an agreement will also include consultation regarding measures to protect threatened and endangered species and providing wildlife surveys to ensure hunting is not harmful to game species. The number of hunters and harvest level allowed shall be ensured to be commensurate with the status of the game populations and compatible with other management objectives. Quotas and regulations for managed hunts will be reviewed by the Commission and established through a public review process. FWC has managed a dove hunt on the property for many years. This activity will continue in accordance with WRP guidelines.

4.3.2 Exotic/Invasive Animals

Wildlife pest species are considered to be those non-native species that are harmful to native wildlife, that negatively impact native vegetation, or that seriously interfere with management objectives. The purpose of wildlife pest management is to reduce populations to attain an acceptable level of impact. When population control measures

are warranted, land managers consult with the Florida Fish and Wildlife Conservation Commission to determine appropriate control techniques that consider public safety and are humane to the species. The effects of pest population control efforts will be monitored by periodic site evaluations.

Feral hogs are likely to become the predominant pest species on Allapattah. Disturbance caused by these animals negatively impacts natural communities and interferes with land management operations. Their high fecundity, habitat adaptability, and incessant rooting behavior combine to make them a potent destructive force and significant environmental concern. Their disruption of soil and vegetation alter natural communities and can be especially damaging in sensitive habitats slow to recover. Land management objectives are affected when rooting disturbance disrupts prescribed burns by preventing the spread of fire. Areas of disturbed soil can also be more susceptible to exotic plant invasion. Rooting disruption can make perilous conditions on hiking and equestrian trails, and hog foraging can have a detrimental impact on reptile populations. While recreational hog hunting is anticipated in the near future, it is also likely that hog populations will reach nuisance levels and will necessitate trapping to control them.

4.3.3 Rare, Threatened, and Endangered Species (wildlife)

Policy 05.00112.2. *Particular emphasis shall be placed on the identification, protection and management of rare, threatened and endangered species.*

Several listed wildlife species are present or have been observed historically, or are expected to be present on Allapattah. Impacts to these species from planned land management and recreational activities are of special concern, and activities that might jeopardize the well being of these species may be altered or cancelled. District land management activities including prescribed burning, hydrologic restoration, exotic vegetation treatment, and understory control can improve environmental conditions that benefit listed species as well as a variety of other indigenous wildlife. The U.S. Fish and Wildlife Service and the Florida Fish and Wildlife Conservation Commission have identified a number of species that could potentially benefit from the planned restoration, as listed on Table 3.

Common Name	Scientific Name	Designation
Crested caracara*	<i>Polyborus plancus audubonii</i>	T (fed/state)
Bald eagle*	<i>Haliaeetus leucocephalus</i>	T (fed/state)
Whooping crane	<i>Grus americana</i>	E (fed)
Wood stork*	<i>Mycteria americana</i>	E (fed/state)
Eastern indigo snake*	<i>Drymarchon corais couperi</i>	T (fed) SSC (state)
Florida panther	<i>Felis concolor</i>	E (fed/state)
Everglades snail kite	<i>Rostrhamus sociabilis</i>	E (fed/state)

American alligator*	<i>Alligator mississippiensis</i>	SSC (state)
Florida pine snake	<i>Pituophis melanoleucus mugitis</i>	SSC (state)
Gopher tortoise*	<i>Gopherus polyphemus</i>	T (state)
Gopher frog	<i>Rana areolata</i>	SSC (state)
Florida mouse	<i>Podomys floridanus</i>	T (state)
Black skimmer	<i>Rynchops nigra</i>	T (state)
Sandhill crane*	<i>Grus canadensis</i>	T (state)
Limpkin	<i>Aramus guarauna</i>	SSC (state)
Little blue heron	<i>Egretta caerulea</i>	SSC (state)
Tri-colored heron	<i>Egretta tricolor</i>	SSC (state)
Reddish egret	<i>Egretta rufescens</i>	R (state)
Fox squirrel*	<i>Sciurus niger</i>	T (state)
Burrowing owl*	<i>Athene cunicularia floridana</i>	SSC (state)

* sighted on Allapattah

Table 3 Listed wildlife species sighted or with potential to be found on Allapattah

5.0 Public Use

Policy 05.00110. The mission of the Land Stewardship Program is to provide natural resource protection and management while allowing appropriate recreational use on designated public lands.

Section 373.1291(1)(a) F.S. states that wherever practical, lands shall be managed and maintained, to the extent practicable, in such a way as to ensure a balance between public access, general public recreational purposes, and restoration and protection of their natural state and condition. Allapattah is also encumbered by a conservation easement to USDA, Natural Resources Conservation Service, issued in compliance with the Wetlands Reserve Program and all public use activities must be in compliance with the easement. The determination of compatible public use will be based on the following criteria:

- Consistency with the reason the lands were acquired
- Restrictions and/or prohibitions imposed by easements, leases, reservations, adjacent land ownership and other conditions of the purchase agreement
- Infrastructure and support facility requirements, such as fences, gates, signage, entry design, stabilized off-road parking, trails, campsites, maintenance and other operational and budgetary impacts
- Opportunities for persons with disabilities
- Limitations resulting from endangered species, other sensitive natural resources, archeological resources or land management practices
- Public health, safety and welfare
- Environmental education program opportunities

A public use planning workshop was held in July 2003 to address public use opportunities on Allapattah Flats. Representatives of local government and state land managing agencies, environmental organizations, and user groups including hunters, hikers, equestrians, and bicyclists were invited to assess the property from the air. The group then convened to provide their input as to what public use opportunities were most important and how they could be accommodated while maintaining the environmental restoration/protection goals for the property. The following were the major points/concerns of the advisory group:

- Separate incompatible uses by area or time period
- Environmental restoration goals are more important than recreational use
- Provide adequate law enforcement and security prior to public opening
- Recreational use should be passive to promote restoration
- Allow all activities unless they are incompatible with acquisition or restoration goals

Following the planning workshop, District staff met onsite with representatives of hiking, equestrian, and bicycle organizations to determine exactly what uses could be accommodated and where for the five year period covered under this plan. It was agreed that the Cottage Road Unit is the least disturbed and offers the best opportunities for public use until additional restoration work is completed.

During 2005-2006 the District will begin developing parking entrances and trails to accommodate hikers, bicyclists, and equestrians in the Cottage Road Unit (Figure 7):

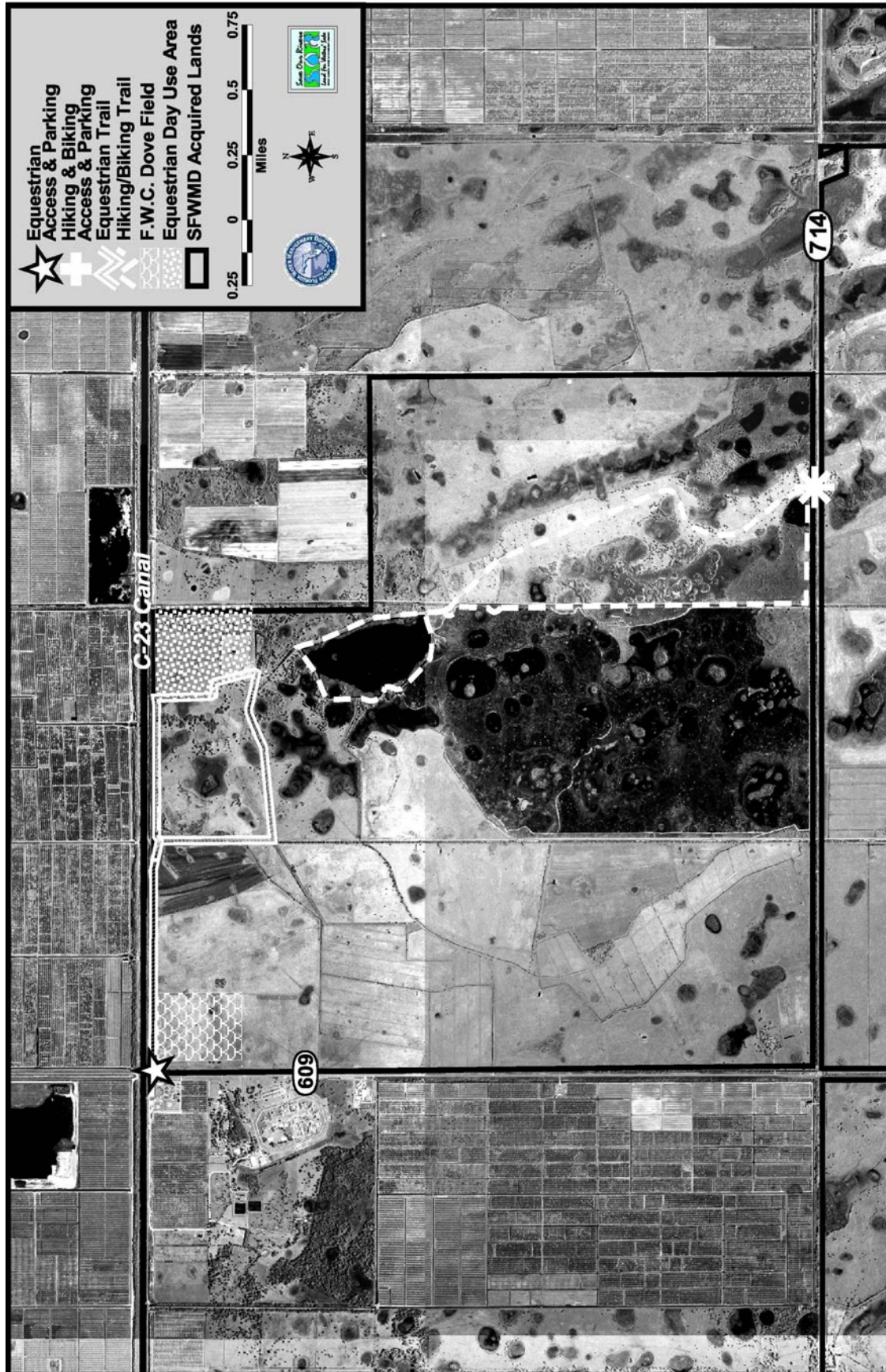
- Parking and entrance for hikers & bicyclists at Cottage Road & CR 714
- Parking & entrance for equestrians at CR 609 & C-23 canal
- Hiking trails (in conjunction with Florida trail Association)
- Off-road bicycle trails (in conjunction with Club Scrub)
- Equestrian trails (in conjunction with Jupiter Horsemen Assn.)

5.1 Special Uses

Special uses by public agencies that are in the public interest will be permitted with the approval and oversight of the lead manager and issuance of a right of entry or other appropriate form of permission.

5.2 Hunting

The Florida Fish and Wildlife Conservation Commission will continue to conduct dove hunts on the fields near CR 609 and C-23 canal in 2004-2005. SFWMD and FWC will be working collaboratively to establish the property as a Wildlife Management Area with expanded hunting opportunities in the future



Allapattah Flats Management Area
 (Proposed Public Use Areas)

Figure 7

6.0 Resource Protection

Policy 05.00111.4. Public use shall not result in detrimental impacts to water resources. When a public use activity produces detrimental effects on water resources, it shall be discontinued until an evaluation determines that such use is compatible.

Policy 05.00113.7. Security and resource protection shall be provided by professional law enforcement services through contractual and non-contractual agreements, to safeguard the public and protect natural and cultural resources on District-managed natural areas.

Management of public activities on Allapattah will require a strong commitment to resource protection while simultaneously promoting all appropriate public uses. This will require an emphasis on enforcement of pertinent rules and regulations to protect natural resources and also provide a safe recreational opportunity.

This can be accomplished through execution of a cooperative management agreement with FWC (or other appropriate security) that would allow FWC law enforcement officers to conduct regular patrols throughout the year, increasing their presence during hunting seasons or at other times when public use is high. Law enforcement surveillance protects natural and cultural resources, deters illegal activity, and safeguards the public.

There is potential to provide supplemental patrols through a contract between the District and FWC for District-wide wildlife law enforcement. The patrols should be structured based on resource needs. At the present time a Florida DOT officer is housed in one of the residences on the property, and there may be similar opportunities for FWC wildlife officers or Martin County Sheriff's deputies.

Resource protection can also be greatly enhanced by the presence and maintenance of continuous, posted boundary fencing to delineate the property perimeter. The Allapattah property perimeter is entirely fenced. The maintenance and repair of the fencing will be an ongoing management concern. Signs delineating the WRP boundary have been installed, and it is anticipated that additional signage identifying the project will be incorporated. In the future internal fencing will be installed, modified or removed as necessary to delineate internal public use areas or augment the restoration.

7.0 Administration

Administration of LSP lands is directed through the Land Stewardship Division. Policy decisions, planning and budgeting, procurement of personnel and equipment, contract administration, and issues of program development are administrative tasks coordinated through the Division. Input is provided from regional land managers located at District service centers over the 16-county area. Regional land managers handle regular administrative duties from their field locations to assure quick response to local concerns and management issues. Allapattah administrative activities are handled through District headquarters in West Palm Beach.

7.1 Planning and Budgeting

Planning is a major function of the LSP mission and is critical to maintain proper program focus, direction, and coordination with other agencies. LSP planning is accomplished by division planning staff and in coordination with individual land managers. Division level planning develops land acquisition strategy and project evaluation, produces the SOR Land Acquisition and Management Plan, and coordinates acquisition planning with other District and outside agency personnel.

Policy 05.00117.4. Annual work plans summarize activities corresponding with annual budget development and are prepared by the Operations Section of the LSP.

Annual work plans are developed each fiscal year for budget preparation and to address activities and projects targeted for completion within the up-coming fiscal year on individual properties. The annual work plan includes performance objectives for exotic plant control, vegetation management, prescribed burning, fencing, infrastructure maintenance, forest management, resource protection, public use development, environmental monitoring, and contract administration.

Land managers submit monthly reports to document progress toward achieving annual work plan objectives. Land managers also meet quarterly to address common problems and plan future management operations.

Policy 05.00115. The District will secure dedicated funding sources, personnel and other resources to support program goals and objectives. Project funding needs and sources for cooperative management agreements with government and non-government entities will be identified during acquisition. A cooperative management agreement will designate a lead manager and identify whether District funding is required.

The principle source of funding for the Land Stewardship Program is the Water Management Lands Trust Fund, administered by the Florida Department of Environmental Protection. Money for this dedicated fund is generated from the sale of state documentary tax stamps and is used for property acquisition and management. Additional funding and support may be obtained from the harvest of renewable resources, land use leases, and in-kind management services from cooperating partners. In the case of Allapattah, significant restoration funding is coming from the Natural Resources Conservation Service through the Wetland Reserve Program. WRP funds can be used for one time management improvements, such as initial exotic treatment, fireline construction, and perimeter fencing, but these funds are not available for recurring management needs.

Budget planning begins in March during the work planning process for the following fiscal year (October-September). Overall budget availability generally determines management activities. Budget distribution among the District's five land management regions is based on a programmatic prioritization of management activities. Operational funds are distributed to most effectively accomplish the management objectives of each management area.

7.2 Infrastructure

Policy 05.00113.11. *Infrastructure support shall be developed and maintained to provide safe access for responsible management and public use on District lands. Such infrastructure includes access points, roads, trails, utilities, and minimal public facilities.*

There are a number of residences, both houses and mobile homes, that are used by the cattle lessee's ranch personnel, as well as other ranch-related facilities. Several residences are also occupied by state law enforcement personnel.

The entire 30 mile perimeter of Allapattah is fenced, but much of it is in need of repair. As landowner, the District is responsible for perimeter fences and any internal fences that may need to be constructed to exclude cattle for restoration purposes. It is anticipated that approximately 20 miles of fence will need to be constructed over the next five years, at a cost of \$10,000/mile. Five and ten miles of perimeter fencing was replaced in 2003 and 2004, respectively. Some internal fencing will be removed and others built to establish appropriate ecologically based management units and accommodate public use.

7.3 Personnel and Equipment

The Land Stewardship Program is separated into five geographic regions, each staffed with professional land managers. Highly trained land management technicians are based at the DuPuis Management Area, the West Coast Field Office, and at the Orlando Service Center, as well as equipment necessary for undertaking the various land management activities.. The Land Stewardship Division director and additional planning staff are located at District headquarters in West Palm Beach.

Management of Allapattah will be the responsibility of the east-coast region land manager, with assistance on leasing issues from the Interim Land Management Program. During 2004 the District will pursue an agreement with Florida Fish & Wildlife Conservation Commission to manage public use and hunting programs on Allapattah.

**Allapattah Flats
Restoration Plan
Appendix A**

Section	Unit Name	Ac.	Primary Character	Existing wetland acreage	Expected wetland acreage	Exotic Species	Construction activities	Length of berm construction	Upland activities	Other
6	Section 6 NW	57	Pasture (thistle, fennel), with small palm hammock and misc. overdrained fw marsh	19	175	BP along ditch bank and fence rows ~ 1.1 miles total (about 3-5 acres total)	Remove 2 culverts (non-functional), minor ditch filling	expected minimal (north borders C-23), west appears to be high ground, though may require augmentation	Pine seedlings would be appropriate in ~75% of Sec. 6, this section has been used as a dove field for years	Maintenance/improvement of existing roadway for management access (roadway could traverse and provide access to Sections 6,7, 18)
6	Section 6 Middle Blk	216	Pasture (thistle, fennel), with small palm/pine hammock and misc. overdrained fw marsh			BP along ditch bank, one BP head mixed with a few pines	Ditch plug, fill 2 short ditches (total ~1000')			
6	Section 6 Pump	82	Pasture (thistle, fennel), a couple of oaks, extensively overdrained marsh wetland			BP along ditch bank, not significant	minor ditch plugs (~500')			
6	Section 6 Southwest	101	Pasture (thistle, fennel), with extensively overdrained marshes			Not significant, BP along ditch at west side property boundary, mixed with pines				
6	Lake 1 (lane)	4	Pasture, thistle, fennel, overdrained			BP along fenceline, not significant				
6,7	West Dove Field	300	Pasture (thistle, fennel), with overdrained fw wetland, former ag field			BP along ditch bank at west side of property, and at south end of field, not significant	Fill drainage ditch at south end of field (~ 1/2mi.), 1 N/S ditch (~3/4 mile) (potentially level this field, particularly in SE corner & middle), block ditch that discharges to 609 drainage ~7 mi.			
6,7	90 acre	100	Pasture (bahia), with some fw marsh, overdrained			BP mixed with pines along southern boundary	Small ditch plugs (150')			Burrowing owl nests located at fringes, manage in low vegetation for habitat, little reforestation
7	101 Pasture	115	Pasture (bahia), with fairly extensive marsh system	38	210	BP along north boundary, mixed with pines on west boundary, and on		1/2 mile	Pine seedlings would be appropriate through about 65% of Sec. 7)	

Section	Unit Name	Ac.	Primary Character	Existing wetland acreage	Expected wetland acreage	Exotic Species	Construction activities	Length of berm construction	Upland activities	Other
						fencelines at eastern edge				
7	Middle Block	185	Pasture (thistle, fennel), sandhill crane nest in this area, overdrained w/ systems			BP mixed with pines along southern boundary	Plug drainage ditches between wetlands	1/4 mile on west, 1/2 mile on south		Some owl nesting, areas north and south to be managed for owl habitat
7,18	54 Field	177	Pasture (bahia, smut, etc)			BP along edge ditches and internal ditches	Level and fill old vegetable field ditches (7.8 mi.), abandon artesian well, maintain roadway integrity			May require herbiciding pasture grasses to jump start wetland growth
	54 Field South	6	Pasture (bahia, smut, etc)			Much pepper on southern, eastern and northern edge of this field	see 54 field			
7,18	77 No Name Pasture	164	Pasture (bahia, smut, etc), with miscellaneous wetland marsh, sawgrass systems, broomsedge, etc.			Some BP on eastern boundary, shared with 54 field, and on southern edge	see 54 field			Manage as burrowing owl habitat, low vegetation, minimal reforestation
18	290 Pasture	373	Pasture (bahia), with some fw marsh, overdrained, sporadic pines	73	240	BP mostly on south boundary and on west ditch bank	Plug drainage ditch at southern end, middle of section (150' plug), plug interwetland ditches (6)	1 -2 miles	Pine seedlings would be appropriate through 45% of Section 18, potential oak/palm as well	Potential for burrowing owl nesting on berms, will require survey, caracara nesting will affect construction timing
18	House	5	Bahia pasture, with overdrained marsh area			Some BP mixed in with pine on fence line	Outparcel from NRCS easement, potential public access point			
5	West of Cow Pens	287	Pasture P/N	84	250	Extensive BP infestation, some lygodium in wetland ares at north end	Install weir at north end of main drainage ditch	None (north bordered by C-23, east by drainage ditch, should assess berm adjacent to east dd, may require augmentation though ground appears high		

Section	Unit Name	Ac.	Primary Character	Existing wetland acreage	Expected wetland acreage	Exotic Species	Construction activities	Length of berm construction	Upland activities	Other
5	North of Pens	87	Pasture P/N			Extensive BP infestation	Level & fill old vegetable field ditches (1.75 miles), abandon 2 artesian wells		Pine seedlings would be appropriate through about 45% of Sec. 5), potential oak/palm as well	
5	Lane 2	5	Fence Lane, Brazilian Pepper			Extensive BP on both fences				
5	East Trap	29	Bahia pasture			Extensive BP mixed with pines and palms				Potential public access area, removed from NRCS easement
5,8	East of Lake	58				BP throughout; some should be mechanically removed				
5,8	Lake	186	FW marsh, open water?	70	225	cattail, BP, wax myrtle	Partially fill perimeter ditch of 'reservoir', construct boardwalk for public/management access			Mow/maintain berm around lake until further analysis to determine future activities
5,8,17	Cattle Rough	1,445	Rhodes grass north, pine flatwoods, depressional wetlands south, with interspersed bay islands, some oak, palm	144	400	Northern portion overdrained, BP along southern end ditch, scattered melaleuca, significant lygodium infestation in bayheads	Fill 2 E/W ditches (3/4 mi. & 1 mi. long)			Potential grasshopper sparrow habitat, may impact construction timing, caracara nesting may affect construction timing
9	Cottage Trap	47	Brazilian Pepper, Oak, Palm	107	315	Significant BP, mixed in with oak, palm	Install weir south of Section 9 north boundary, remove old fence & install boundary fence	1 mile (on north boundary), east boundary ditch may not need berm, if it does, 1 mile	Pine seedling appropriate east of main slough and on either side of Cottage Rd., also some oak	Existing fenceline may be outside property line, will need to re-fence, access is difficult & will be more difficult as property gets wetter

Section	Unit Name	Ac.	Primary Character	Existing wetland acreage	Expected wetland acreage	Exotic Species	Construction activities	Length of berm construction	Upland activities	Other
9,16	77 West	447	Pasture (bahia), slough wetland north (overdrained)			Misc. BP, cogon grass, Chinese tallow, some lygodium in slough, area appears to have been sodded intensely; water stands in areas that are not designated as wetland soils.		1 mile (Sect. 16, south), 1 mile (Sect. 9, north), 1 mile (Section 9 east)	Center of Section 9 may be appropriate for pine seedlings	Section 16 appropriate for prescribed burn, will require shredding/fuel reduction, also potential to remove west fence line, merge with Cottage Rd. unit & 77 East, remove fence at west side of 77W and 77E, construct fire break in association with berm construction, clear & reference north property boundary
9,16	Cottage Road	612	Bahia pasture, bay heads, oak, palm hammock, fw depressional wetland	177	300	BP spread throughout, especially east, and along fence line separating from 77 W	Out parcel from NRCS easement at south end & east of access road ~26 acres, potential future parking area	Some minimal berm at south end to augment existing road		Main public access point, maintain road/install at-grade crossings as necessary to reestablish wetland connections, burn in 2004
9,16	77 East	159	Bahia pasture			Some pepper on fenceline	Fill drainage ditches at eastern edge of the property (~ 3/4 mile total), construct fire breaks, burn 'slough' area prior to rehydrating	existing ditch at south end, associated spoil may need augmentation		Potentially remove fence, merge with 77 West
19	Baily 2	314	Bahia pasture, with overdrained marsh area	106	200	BP on west fence line (double row)	Fill two main drainage ditches e/w (~ 2 miles), scrape or treat bahia pastures to remove grass, maintain northern ditch connection to main n/s drainage ditch and don't fill from there to approx. 150' east of the caracara nest site.	Minimal (existing in most places on north and west, may need augmentation)		Known caracara nest site, will restrict construction (no const. Nov.- March)
19, 30	Baily 3	386	Bahia pasture, with fairly extensive marsh system			BP on west fence line (double row)			Appropriate for sparse pine plantings, palms	Known burrowing owl nest site (south side of drainage ditch)
30	Section 30	616	Bahia pasture, with fairly extensive marsh system	136	330	BP on northern fence line, plus west boundary and center ditch, torpedo grass in some wetlands, particularly on west side		1/2 mile		

Section	Unit Name	Ac.	Primary Character	Existing wetland acreage	Expected wetland acreage	Exotic Species	Construction activities	Length of berm construction	Upland activities	Other
31	73 Pangola	640	Bahia pasture, fairly good marsh system, with maple(?) bay, cypress in sw corner	166	450	BP on west fence line plus scattered throughout, wax myrtle, salix in wetlands, guava on south fence line	Plug drainage ditch that discharges to south perimeter ditch, fill or plug diagonal drainage ditches (near tower), construct berm around cell tower property	2 miles		
20	55 Field	119	Bahia pasture	142	285		Level & fill old vegetable field drainage ditches at NW corner (5.25 miles), maintain northernmost E/W oriented ditch/berm, but plug at N/S canal	1/2 mile to 3/4 mile on north, already exists over much of area, may need improvement	Appropriate for sparse pine plantings, palms	Within primary or secondary zone (Section 19) of caracara nesting--will restrict construction timing, also burrowing owl nest site on east side of field
20	Section 20 Northeast	221	Bahia pasture							
20	Section 20 Southwest	135	Bahia pasture				Remove bahiagrass from slough (~ 500 feet either side of ditch), followup herbicide as necessary			
20	Section 20 Southeast	132	Bahia pasture				Series of double drainage ditches, should be leveled to natural grade			Access may get difficult as property gets wetter
29	West Pens	2	Bahia pasture		250					Limp grass gets thicker as it gets wetter, may require pre-restoration herbicide treatment
29	29 West	137	Limp grass pasture							
29	29 West South	42	Limp grass pasture			limpo				see 29 W
29	29 East	254	Limp grass pasture			limpo	Herbicide limpo as necessary			Access may get difficult as property gets wetter, maintain adequate access from property line easement
29,28	Old Watermelon	164	Bahia pasture			Some pepper	Level & fill old watermelon field ditches (~5 miles), maintain center ditch and berm until weirs installed			Potential burrowing owl nesting on berms of old field

Section	Unit Name	Ac.	Primary Character	Existing wetland acreage	Expected wetland acreage	Exotic Species	Construction activities	Length of berm construction	Upland activities	Other
29,32	Tide Field	526	Heavy brush, mostly pepper, with bahia, smut		230	Extensive pepper infestation, along every ditch and within field proper, torpedo grass in some wetlands	Level & fill old vegetable field, clear BP & burn, (~11 miles) to refine upland/wetland character, maintain ditch at FPL easement		pine seedlings appropriate on upland areas of old field	Access at property line easement may get difficult as property gets wetter, may require raising elev. &/or shell for road stabilization
29,32	55 Rough	255	Bahia pasture							
21	Watermelon West	147	Bahia pasture		330		Construct weir in drainage ditch south of 714	1/2 mile (on north)		
21	Oil Pad	173	Bahia pasture				Plug or fill ditch draining wetland in center of section			
21	Watermelon II West	110	Bahia pasture							
21	Watermelon II East	156	Bahia pasture							Will likely need geoweb crossings in existing roadway to allow continued access as property gets wetter, may require additional access improvements
28	88 West	185	Wetland hardwood							
28	88 East	346	Bahia pasture		330		Plug ditch at southern end of section			
28,33	74 Rough	335	Bahia pasture				Plug two drainage ditches between wetlands (2 50-100' plugs)			
33	74 Carib	346	Bahia, bluestem		255	Significant wax myrtle in southwest corner	Plug ditches at discharge to N/W ditch	1/2 mile to 1 mile		
22	22 West	298			250		Potentially fill ditch that crosses whole section at bottom (or provide modified culvert/water control structures	1/2 to 3/4 mile on north, 1/2 mile on east		
22	22 East	307	Bahia pasture, smut grass, others		250					
27, 34	27 West	336	Bahia pasture		365	Chinese tallow along access at west side, torpedo grass in some wetlands	Potentially fill main drainage ditch down center of both sections, misc. plugs in wetland to wetland ditches	1/2 mile (on east of 27)		As property gets wetter management access will get difficult, may want to consider improvement of mgmt. road ways

Section	Unit Name	Ac.	Primary Character	Existing wetland acreage	Expected wetland acreage	Exotic Species	Construction activities	Length of berm construction	Upland activities	Other
27, 34	27 East	365	Bahia pasture				See 27 West	1 1/2 mile (1/2 on east, 1 mile on south - for 34)		
34	Carpon	298	Bahia pasture		360		Fill or plug main N/S ditch (or modify, improve culverts) Ditch runs 2.6 miles N/S, with connection to 1 mi. long E/W ditch			
34	88 Pangola	257	Bahia pasture							
Parcel C										
22, 23	Beef Pasture A	46	Bahia/smutgrass and bahia/smutgrass/fennel, fw wetlands with maidencane, pickerelweed, smartweed, also salix, myrtle			BP along all fencelines, throughout pasture, very thick in rows west of cow pens				Nice oak/palm hammockin pasture
22,23	Beef Pasture B	6								House & yard
22, 23	Beef Pasture C	57	Bahia,smutgrass, thistle, fennel, matchweed, FW marsh wetlands with pickerel, mc, smartweed			BP along edge of large central hammock, in northwest corner and along northern fenceline, ew around wetland in hammock. Cogon grass on northern side of large central hammock and in some clearings				Nice oak/palm/pine hammock with large wetland in middle
22,23	Beef Pasture D	21	Bahia pasture, also with dock, fennel, clover, matchweed. FW wetland (maidencane, pickerel, smartweed)			BP among pines in northeast corner, and on southern end.				Horses present, plus N/S cross fence
23	Bull Pasture	80	Bahia, smutgrass, thistle, fennel, matchweed. FW marsh wetlands (pickerel, maidencane, smartweed with myrtle and salix)		340	BP throughout, along all fencelines and canals			Much of Section 23 appropriate for sparse pine seedlings	Trash piles at north end, blackberries in center, red shouldered hawk nest in NW corner of central wetland.
23	Bull Pasture II	34	Primarily bahia in sw corner, remainder is mixed with thistle, smutgrass, fennel, matchweed, with fw marsh wl, (pickerel, maidencane, smartweed)			BP throughout, along all fencelines and canals				blackberries in pasture

Section	Unit Name	Ac.	Primary Character	Existing wetland acreage	Expected wetland acreage	Exotic Species	Construction activities	Length of berm construction	Upland activities	Other
23	Bull Pasture III	82	Bahia, bahia/smutgrass, with fw wetland (pickerel, maidencane, smarthweed, plus myrtles and salix)			BP along and in northern wetlands, along eastern canal and fenceline, melaleuca in central wetland on western edge				North 1/3 thick smutgrass, ditch erosion
23	Bull Pasture IV	68	FW marsh dominated by juncus, with some maidencane, torpedo, bermuda grass, some open water,			Extensive BP in western corner along road				Torpedo grass in/ around wetland
23	Bull Pasture 4A	27	Bahia, smutgrass, thistle, fennel, matchweed. FW marsh wetlands (pickerel, maidencane, smartweed), also bermuda, sida acuta, fennel.			BP along central canal and in pasture, water lettuce in central canal at south end				Water lettuce
23	Bull Pasture V	37	Bahia, smutgrass, thistle, fennel, matchweed. FW marsh wetlands (pickerel, mc, smartweed with myrtle and salix)			BP in northeast corner, along eastern fenceline, melaleuca in northwest wetland, on eastern edge of wetland				Castor beans, blackberries
23	Bull Pasture 5A	44	Stargrass, fw wetland with pickerweed, maidencane, smartweed			BP along central canal and northern fenceline				Very tall stargrass, horses present
23,24	North Airport 1	10	Weedy, old horse corral			Melaleuca (on eastern fenceline)				Totally overgrown weedy mess (old horse pasture), behind ranch office
23,24	North Airport II	31	Eastern third of pasture is cyperus/bahia, remaining is bahia/fennel. Two small ponds at southern end			BP along fencelines, in two rows at southern half of pasture				
23,24	NorthAirport III	28	wetland with edges of bahia, fennel, smutgrass			BP along fencelines				Thick myrtle & willow, E/W fence runs thru middle of wetland
24	North of Lane	417	Bahia pasture/Bahia-smut pasture with freshwater marsh (maidencane, pickerelweed, smartweed dominant), also some with myrtle and salix		180	BP along fencelines, along eastern and northern canal, along an din southwest corner of central wetland	berm on east and north (?) side (2 miles)		appropriate for pine seedlings/mesic/hydric flatwoods	Torpedo grass around central wetlands, very tall thistle in south 1/2

Section	Unit Name	Ac.	Primary Character	Existing wetland acreage	Expected wetland acreage	Exotic Species	Construction activities	Length of berm construction	Upland activities	Other
24,25	South of Lane	367	Bahia pasture with freshwater marsh (maidencane, pickerelweed, smartweed dominant), also some with myrtle and salix			BP along fencelines, under pine trees on west side	Berm for 1 mi. on east, fill ditch (~ 1 mile (remove/burn pepper)			Blackberries in western 1/3, red shouldered hawk nest at south end in pine, south end has good tall pines, north 1/2 bahia w/fennel, south 1/2 good bahia, may need to roller chop myrtle
25	Baily 1 North	238	Bahia pasture/Bahia-smut pasture with freshwater marsh (maidencane, pickerelweed, smartweed dominant), also some with myrtle and salix		250	BP along all fencelines and along canal, and in ne corner. Hyacinth in canals on western/southern border	Fill 2 main drainage ditches, ~ 1.25 miles, remove/burn pepper		Appropriate for pine seedlings--mesic/hydric flatwoods	
25, 26	South Airport	232	Bahia pasture with freshwater marsh (maidencane, pickerelweed, smartweed dominant), also some with myrtle and salix		485	BP extensive along all fencelines, throughout pasture among trees on west and south ends. Totally overgrown road on south end	Fill ~1/2 mi. of ditch			Canal bank erosion (likely to be handled with fill)
23	East of Cow Pens/A/B/C	39	Bahia, smutgrass, thistle, fennel, matchweed, fw marsh wl.			BP extensive along fencefines, north of road and along southern canal				some torpedo grass in C
26,27	Hammock Pasture	430	bahia, with cyperus, fennel, etc. Very rough. FW wetland with some salix and myrtle			BP extensive throughout pasture and fencelines				Access difficult, gate in SE corner goes nowhere (into canal)
36	Baily 1 South	358	Bahia pasture/Bahia-smut pasture with freshwater marsh (maidencane, pickerelweed, smartweed dominant), also some with myrtle and salix		615	BP along fencelines, very thick at southern end of pasture	Fill or plug ditches (probably plug, most ditches not very functional, ~length of ditches - 6 miles	1 mile on east by 1/3 mile on south		Artesian well in south end of large wetland , extensive persimmon in nw corner (near wetland), northern part burned in March 2003 by lessee, anticipate southern boundary as access
26	Pump pasture (partial)	15	some bahia, mostly pepper/myrtle			BP extensive throughout				Myrtle infestation, access very difficult
		15516		1262	7870					

Appendix B. Budget and Schedule

Allapattah West

Year 1	Exotics Treatments	\$ 25,000
	Fencing	\$ 15,000
	Construction	\$ 200,000
	Prescribed Fire (fire lines/fuel red.)	\$ 7,000
	Monitoring	\$ 1,400

Total	\$ 248,400
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Year 2	Exotics Treatments	\$ 25,000
	Construction	\$ 75,000
	Monitoring	\$ 700
	Prescribed Fire	\$ 5,000
	Planting (pine and cypress)	\$ 54,000
	Fencing	\$ 10,000

Total	\$ 169,700
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Year 3	Exotics Treatments	\$ 20,000
	Construction	\$ 25,000
	Monitoring	\$ 700
	Planting (cypress)	\$ 30,000
	Prescribed Fire	\$ 2,250

Year 4	Total	\$ 77,950
	Exotics Treatments	\$ 20,000
	Planting (remaining cypress)	\$ 20,000
	Monitoring	\$ 700

Total	\$ 40,700
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Year 5	Exotics Treatments	\$ 10,000
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Total	\$ 10,000
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Five Year Total = \$546,750

Activity	NRCS	SFWMD	SFWMD/Credit	Total	FY03 Actual	FY - 04	FY -05	FY - 06	FY -07
Allapattah East									
Vegetation management									
<i>Exotic species control</i>									
lygodium (climbing fern)	\$725,250.00	\$191,750.00	\$50,000.00	\$967,000.00	\$50,000.00	\$275,000.00	\$225,000.00	\$225,000.00	\$192,000.00
invasive woody vegetation (brazillian pepper, melaleuca)	\$975,000.00	\$292,157.20	\$32,842.80	\$1,300,000.00	\$160,635.69	\$325,000.00	\$350,000.00	\$263,000.00	\$201,364.31
aquatic plant control (hyacinth, torpedo grass)	\$315,000.00	\$105,000.00		\$420,000.00		\$100,000.00	\$150,000.00	\$100,000.00	\$70,000.00
Subtotal exotic Treatment									
Prescribed burning	\$326,662.50	\$35,700.00	\$48,187.50	\$410,550.00	\$7,500.00	\$95,145.00	\$102,635.00	\$102,635.00	\$102,635.00
Vegetation mapping			\$25,000.00	\$25,000.00		\$25,000.00			
Subtotal Prescribed Burn.									
Fencing/maintain perimeter, remove interior as restoration progresses and grazing is reduced	\$150,000.00	\$50,000.00		\$200,000.00		\$80,000.00	\$40,000.00	\$40,000.00	\$40,000.00
Subtotal Fencing:									
Water Quantity Monitoring (wetland depth and duration)									
Hydrologic Instrumentation									
Equipment and Installation	\$120,000.00			\$120,000.00		\$120,000.00			
Data Collection/Analysis			\$90,000.00	\$90,000.00		\$21,000.00	\$23,000.00	\$23,000.00	\$23,000.00
Ecological Monitoring									
<i>Instrumentation</i>	\$20,000.00			\$20,000.00		\$20,000.00			
<i>Data Collection/Analysis</i>			\$140,000.00	\$140,000.00		\$35,000.00	\$35,000.00	\$35,000.00	\$35,000.00

Subtotal Monitoring:									
Construction									
<i>fill ditches</i>	\$3,169,337.50	\$873,112.50		\$4,042,450.00		\$895,440.00	\$1,900,000.00	\$850,000.00	\$397,010.00
<i>berms (for adj. Impact abatement)</i>	\$525,000.00	\$175,000.00		\$700,000.00		\$325,000.00	\$250,000.00	\$125,000.00	
<i>Water control structures</i>	\$618,750.00	\$206,250.00		\$825,000.00		\$325,000.00	\$325,000.00	\$175,000.00	
			Totals	\$9,260,000.00	\$218,135.69	\$2,641,585.00	\$3,400,635.00	\$1,938,635.00	\$1,061,009.31

Prescribed Grazing Plan

***Prepared for
South Florida Water Management District
Allapattah Ranch
Parcel A & B***

In

Martin County, Florida

In cooperation with

Martin Soil & Water Conservation District

And

***United States Department of Agriculture
Natural Resources Conservation Service***

July 18, 2002



Table of Contents:

1. Definition
2. Purpose
3. General Description
4. Objectives
5. Livestock Forage Inventory
6. Forage Inventory Map
7. Annual Grazing Schedule
8. Grazing Map
9. Recommended Grazing Heights
10. Adjustments to the Grazing System
11. Operations and Maintenance
12. Contingency Management Plan
13. Projected Stocking Reduction Based on Expected Restoration

1. Definition:

Prescribed grazing is the controlled harvest of vegetation with grazing and browsing animals, managed with the intent to achieve a specified objective. For this project Prescribed grazing will be used as a tool to assist in the restoration of the Ranch, in conjunction with Brush Control, Pest Management, and other practices needed to restore wildlife habitat, natural hydrology, and native plant communities. The grazing plan will be adjusted as needed to address resource concerns and the restoration objectives.

2. Purpose:

This practice will be applied as part of a conservation management system to accomplish the following objectives:

- **Restore wildlife habitat on wetland and upland sites in accordance with the procedures and policies of the USDA Wetland Restoration Program (WRP)**
- Maintain a stable and desired plant community, and improve or maintain the health and vigor of selected plants.
- Maintain or improve water quality.

Note: This plan will be reviewed annually by the owner/operator. If the number of livestock (10% or more) or the forage condition changes the plan may need to be revised.

3. General Description:

The Ranch is located on Road 714 in Martin County. The property is currently managed as a cow/calf operation. The pastures in their current condition are capable of producing enough forage to support **2,832 animal units (AUs)**. The system in its present condition can support an average of 2832 cows, with an average weight of 1000 lbs. Since it was requested to eliminate grazing on the south part of Field #86 the adjusted carrying capacity is **2,728 AU**.

The purpose of the plan is to use grazing animals to assist in the vegetation management of the Ranch. The primary grazing animals are beef, Brood Cows. Bulls and Heifers may be included in the herd system as needed as long as the overall suggested stocking rate is maintained.

One animal unit (AU) is one mature cow of approximately 1,000 pounds and a calf up to weaning, usually six (6) months of age, or their equivalent. To estimate animal units for Heifers and Bulls use the following AU values.

Bull (Mature) = 1.35 AU

Heifer (2 Yr.) = .80 AU

Heifer (4 Yr.) = 1.0 AU

4. Objectives:

The landowner's objectives are to restore the hydrology of the site, restore the natural ecological communities on wetland and upland sites. The grazing and restoration activities will minimize impacts to other resources, specifically water quality during the restoration process. The objectives of the prescribed grazing plan are to improve and/or maintain an optimum level of the native forages and assist in the reduction of biomass. The proposed grazing plan considers animal health (domestic and native) by using a stocking rate that will provide the needed forage and browse for the animals while protecting the natural resources of the site. The Recommended Initial Stocking Rate is based on a comprehensive forage inventory conducted on the ranch in the spring of 2002. The proposed grazing plan also considers minerals and other supplements needed by the animals. The type and suggested season for providing the needed supplements be shown on the grazing schedule. The profitability of the site as a Cow Calf Operation was not taken into account in this plan and will be to the land user and the SFWMD to determine.

5. Livestock Forage Inventory:

Livestock Forage Inventory is based on estimates of the available forage in each pasture and ecological community. These estimates are used to project stocking rates and annual supplemental feed requirements. The following Livestock Forage Inventory was created prior to the development of this plan.

The forage inventory did not identify indicators of poor grazing management, such as overgrazing or large denuded areas. The measurements and observations taken at the time of the inventory indicated that the property is and has been stocked at or below the carrying capacity for the season and climatic conditions. However, a large number of pest plants were found during the forage inventory. The pest plants include numerous species of common and exotic, invasive plants. The implementation of Proper Pest Management Activities will help to reduce or eliminate negative impacts to wildlife and water quality. Pest Management Practices will be listed in the restoration plan. (See Invasive Species Layout Map to see invasive species distribution)

The Livestock Forage Inventory was based on management and weather conditions that existed in 2002. Annual forage production will vary due to climatic conditions and management of grazing system. The forage inventory should be evaluated on annual or semi-annual basis to ensure proper stocking rate according to the goals listed for the site and to meet the forage requirements of the livestock.

(See Enclosed Forage Inventory)

6. Forage Inventory Map: (See enclosed Plant Community Map)

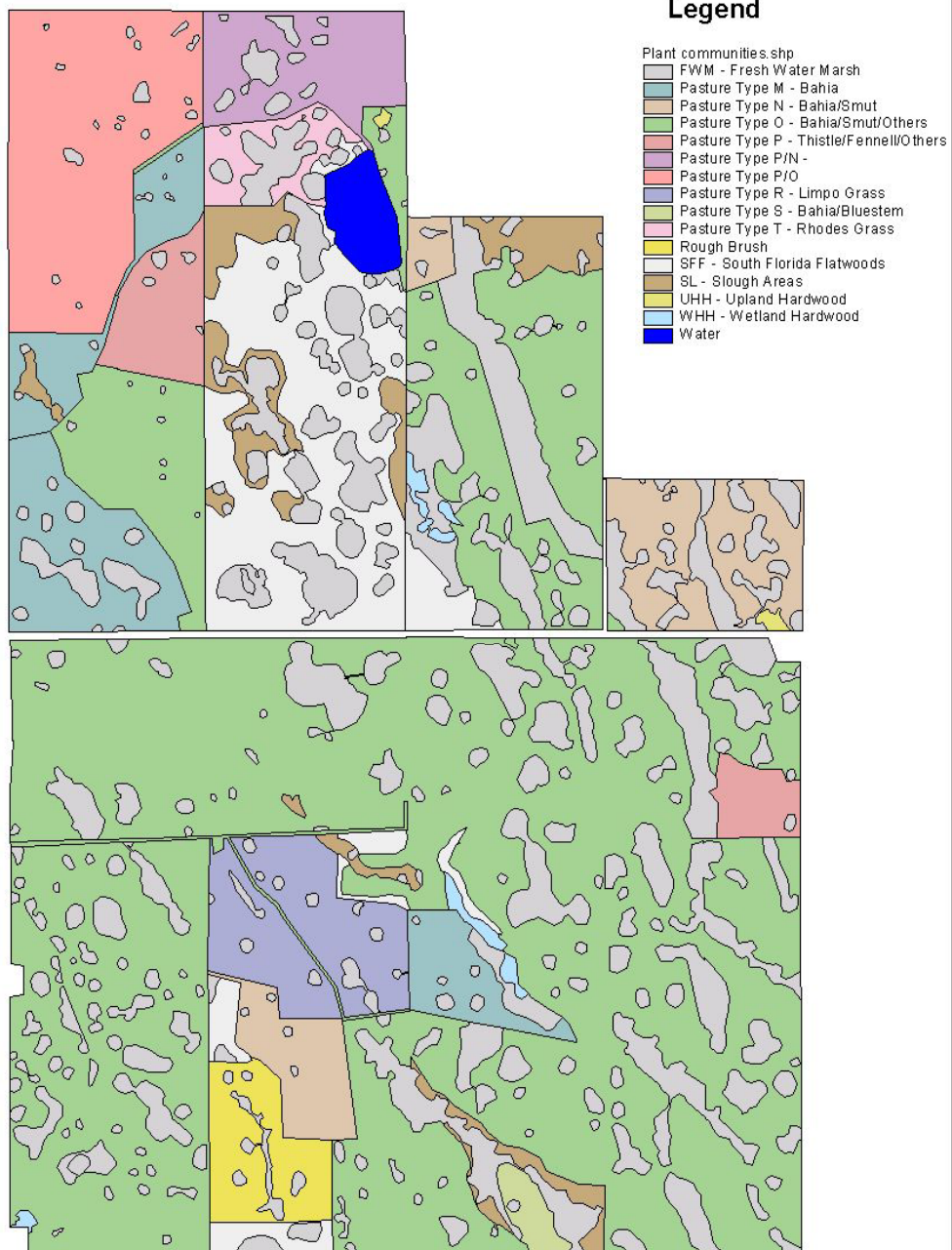
Allapattah Existing Plant Communities

SFWMD

Martin SWCD

Date: 07/18/2002

Ft. Pierce Service Center
USDA-NRCS



4000 0 4000 8000 Feet



7. Annual Grazing Schedule:

Annual Grazing Schedules are designed to account for variations in the amount and growth of forage due to changes in climatic conditions. The following schedule should be used as a **guide** only. Actual rotation schedules should be based on amount and conditions of forage in each pasture. Please refer to section 9 for proper grazing and stubble heights.

Allapattah Ranch

Technician: I.Reyes

Date: July, 2002

**Suggested Annual Grazing
Schedule for 12 Months
Rotation for Brood Cows**

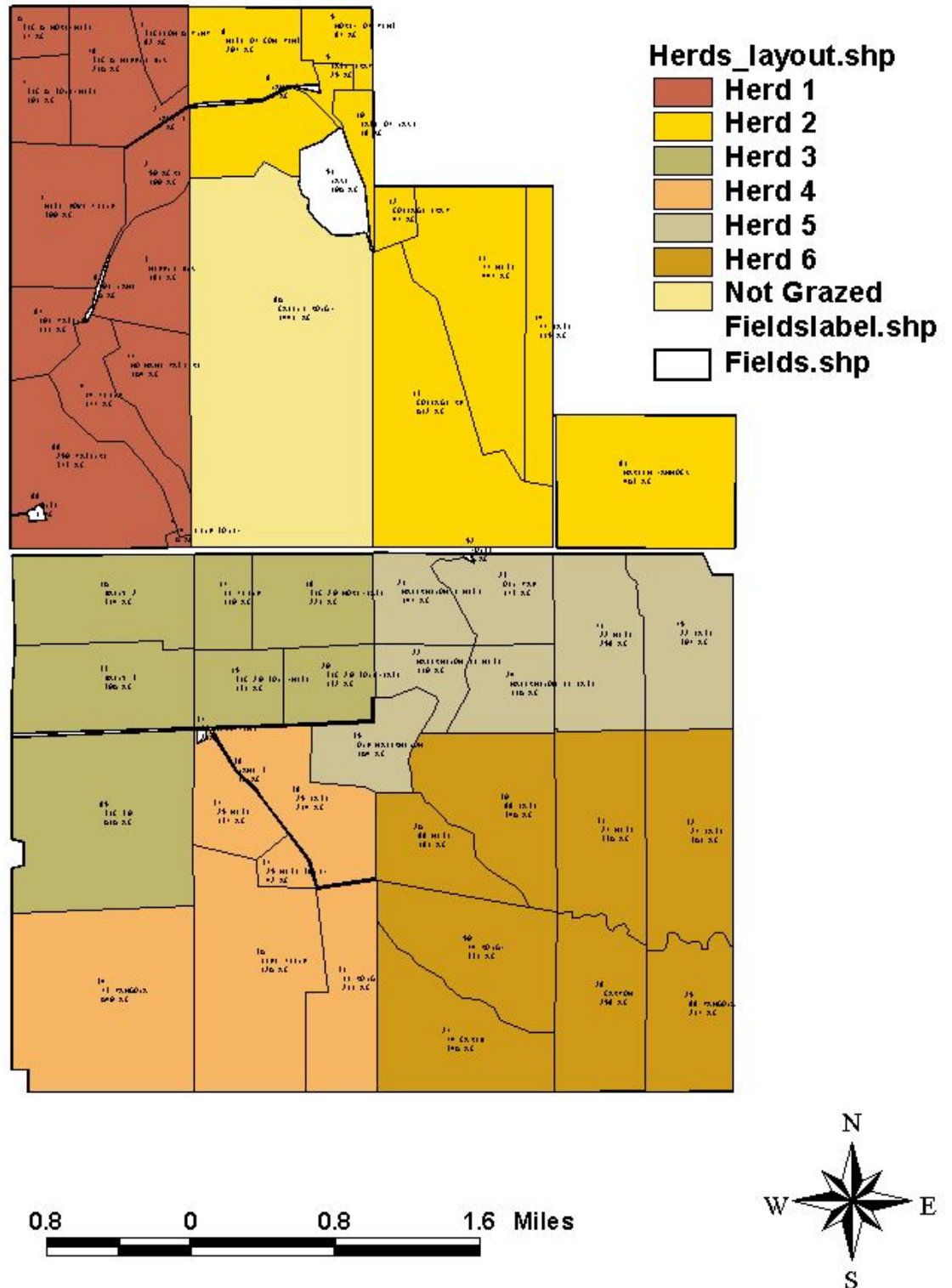
Herd ID		(by months, show planned in and out dates for each herd and grazing unit.)											
and Type	Field ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Herd 1 448 AU	1												
	2												
	3,77												
	4												
	5,6,7,78												
	87												
	88												
Herd 2 455 AU	8,9,10, 86N												
	12,14,15												
	13												
	81												
	86 Range	Not Grazed area (As Requested by SFWMD), North end of the field should be fenced											
Herd 3 423 AU	16												
	17,18												
	19,20												
	33												
	89												
Herd 4 574	34												
	35												
	36												
	37												
	38												
Herd 5 271 AU	21												
	22												
	23												
	24												
	39												
	75												
	79												
Herd 6 544 AU	26,30												
	27,90												
	28,29												
	31,32												
SUPPLEMENTS *		XO	XO	XO	XO	XO							
SUPPLEMENTS- PROTIEIN = X, SALT AND MINERAL = 0													
Notes:													
For Use As A GUIDE ONLY!													
Important: base grazing periods on the forrage plants required on the required stubble heights as shown in Section 9. Environmental conditions such as soil moisture, temperature, forage quality, ect, will be consider by the manager when determining actual rotation schedule.													

AU = Animal Units (1000 lbs Cow)

Cows in

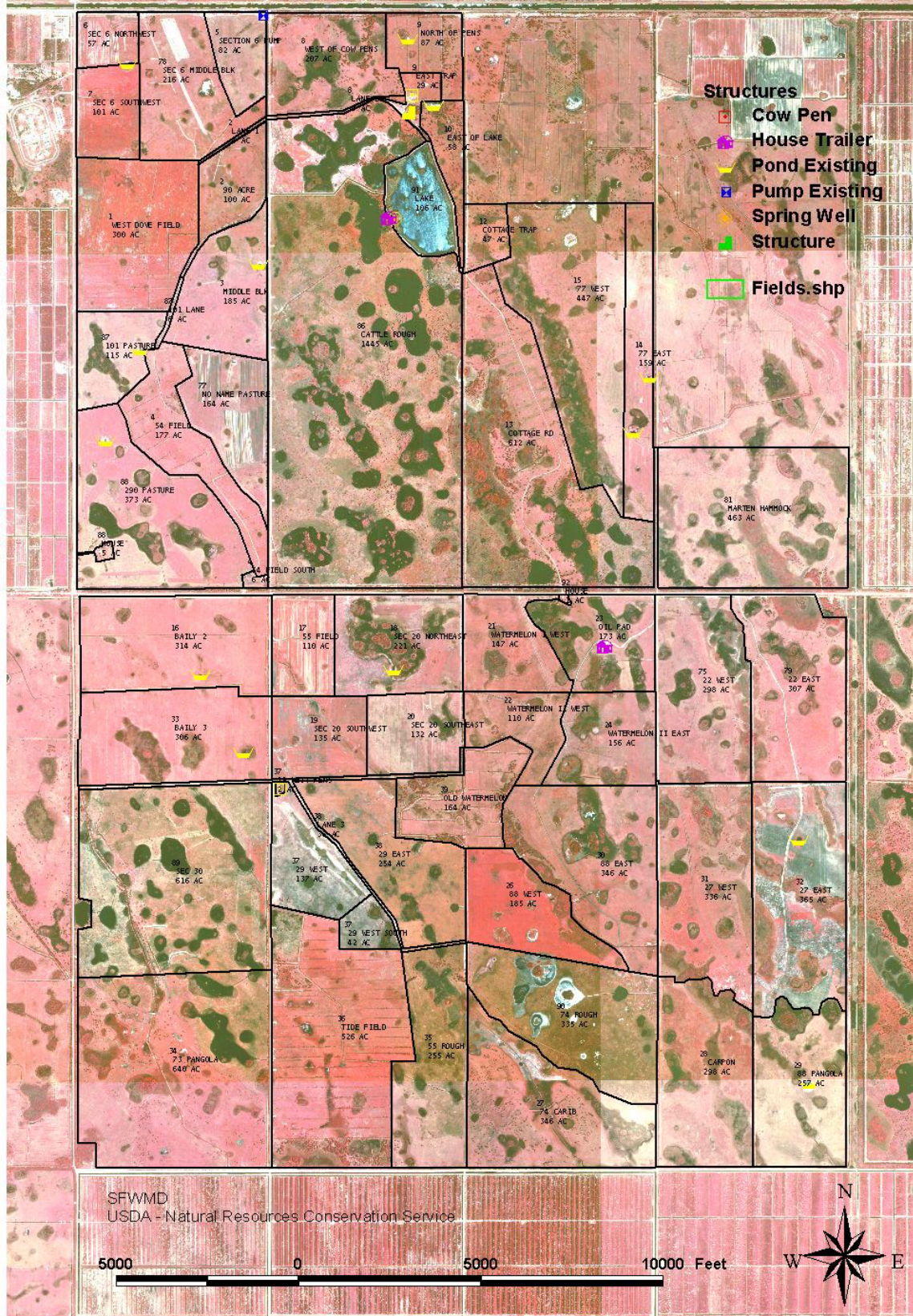
Cows out

Suggested Herd System



6. Grazing map:

Allapattah Fields Layout



9. Recommended Grazing Heights and Length of Grazing Periods:

Grazing animals can rapidly and substantially alter the productivity and amount of forage in each pasture because of grazing preferences and animal distribution. Overgrazing adversely affects wildlife habitat, plant growth, water, soil conservation, and plant persistence. Animals prefer improved pasture forages like the one listed below and avoid plants that are coarse and hard to digest. During the late spring, summer and early fall cattle tend graze upland areas and avoid grazing in wetlands such as sloughs and marshes if adequate forage is available. However, limited availability of forage plants on upland areas may induce more grazing of the wetland plants in some seasons, and could result in overgrazing. Under-grazing results in forage waste, reduced quality, and reduced tiller development. Therefore, the number of animals on a specific area must be balanced with available forage to achieve the goals and objectives for this site. This will require monitoring of the forage availability on a regular basis and adjusting the stock density as needed to maintain a unique balance of desirable forage and important wetland vegetation.

The following table lists common forages found in South Florida along with recommended heights to maintain healthy stands of forage:

FORAGE TYPE	Min. Ht. To Begin Grazing	Min. Grazing Ht.
Bahia grass	6"	2"
Limpo grass	12"	4"
Pangola Digitgrass	8"	6"
Maidencane	12"	6-8"
Chalky bluestem	12"	6-8"

Grazing heights for native forage plants is dependent upon the species and the time of year the plant is grazed. For Native Grasses, ***remove no more than 50% (by weight) of the plant in any grazing event*** This will provide proper use of the forage while maintaining sufficient plant material to, provide wildlife habitat, protect the soil resource, and maintain the health of the plant community.

Grazing periods should be kept relatively short to prevent the plants from being grazed before they have the opportunity to recover from the last grazing event. This will depend on the size of the herd and the area to be grazed. Use the forage heights shown in the previous table to determine the length of the grazing periods.

Rest Periods should be provided between grazing events to all the plants to recovery from the effects of grazing. The recovery periods should be long enough to allow the forages to reach the *Minimum Height to Begin Grazing*. Because the rest periods are based on the growth rate of the plants the length of the rest period will vary. The recommended recovery periods are shown in the following table:

	Resting Periods Based on Forage Growth Rate
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Forage Type	Forage Growth Rate		
	<i>Fast</i> (June 1-Sept 1)	Moderate (Mar 1-June 1 Sept 1 – Nov 1)	<i>Dormant</i> (Nov 1- Mar 1)
Bahiagrass	14-28 days	28-35 days	35-60 days or more
Limpograss	14-21 days	28-35 days	35-60 days or more
Pangolagrass	7-21 days	21-28 days	28-60 days or more
Maidencane	28-35 days	35-45 days	45-60 days or more
Chalky bluestem	28-35 days	35-45 days	45-60 days or more

10. Adjustments to the Grazing System:

Adjustments in the grazing management system will be necessary during and after restoration and other management activities, such as planting, prescribed burning or pest management. The adjustments will provide a suitable period for the vegetation to recover from the management activity or as dictated by pesticide label restrictions. A deferment from grazing means the complete removal of **all** domestic animals for the duration of the deferment.

If buffer areas are developed around specific wetlands or other areas within the Ranch during the restoration process, livestock grazing may be permitted during dry periods of the year. This will help to utilize available forages within the buffer and control woody vegetation. Stocking rates should be adjusted to assure that grazing is complete within one week. The minimum grazing heights listed in Section 9 for corresponding grasses shall not be exceeded.

When prescribed burning is applied, grazing shall be deferred as follows:

Improved pasture areas	30-60 days during the growing season (Mar1-Oct1)
Flatwoods	30-90 days during the growing season (Mar1-Oct1)
Fresh Water Marsh and Slough	30-90 days during the growing season (Mar1-Oct1)

Areas that have been disturbed and planted to native vegetation shall be deferred from grazing for a minimum of 1 complete growing season following planting or until the grass is well established and produces seed. Native grass plantings generally require 2 complete growing seasons to become well established. The deferment shall continue until a NRCS Rangeland or Grazing Land Specialist has provided approval. Temporary fences may be used to protect small areas during the deferment period.

Areas that have been mechanically treated to control and other planted will be provided a deferment period to allow herbaceous plants to recover. The deferment will be minimum of 90 consecutive days during the period of March 1 to December 1, unless only spot control was applied.

If herbicides used to control common weeds and invasive species the grazing management will be adjusted to meet the requirements (if any) listed on the herbicide label. Cattle will not be allowed to re-enter the area for the duration shown on the herbicide label.

11. Operation and Maintenance:

The location of mineral and supplement feeders will be moved routinely to evenly distribute grazing animals throughout the pasture. The herd will be rotated to a fresh pasture when the average stubble height falls below the recommended minimum grazing height (See Section 9). When possible, the grazing period should be 14 days or less and the pastures allowed a recovery period of 21 days or until the forage reaches the recommended height to begin grazing (See Section 9).

It is recommended that records be kept regarding the management of the grazing system in order to properly evaluate and modify the grazing system. These records may be maintained by the manager of the grazing system and provided to representatives of the USDA-Natural Resources Conservation Service for plan revisions. If records are maintained, the following information for each field is recommended:

- Date animals are moved from one pasture to the next.
- Name of herd.
- Number of animals in the herd.
- Field the animals were moved from.
- Field the animals are moved to.
- Notes on forage conditions when animals are moved into and out of each field (i.e. forage height, forage quality, weeds, insects, etc.).
- Body condition score of animals when they are moved.
- Notes on management activities that have been conducted, such as when supplement feeders were moved, and when weeds were sprayed.

12. Contingency Management Plan:

Forage supplies shall be evaluated daily or weekly to determine if forage supplies and quality are adequate to meet livestock demand. When the forage is not adequate, the grazing system should be adjusted or supplemental feed may be supplied.

When prolonged periods of adverse climatic condition effect the supply of forage, the grazing system and/or stocking rates shall be adjusted or additional supplemental feed may be provided.

13. Projected Stocking Reduction Based on Expected Restoration

Projections of forage production following different restoration scenarios are shown below. The projections were developed by estimating the change in acreage due to restoration activities and assigning them a predicted forage production value based on

assumed future conditions. This process accounted for the increased amount of wetlands and the decrease in the amount of upland pastures, as well as changes in the productivity of the plant communities. In addition, the conversion of improved pasture acres and reduced productivity was accounted for on this process. **The projected forage inventory following restoration is an estimate of the forage production expected if 100% of the wetland are restored as listed by mapped hydric soils. This projected forage inventory is an estimate and is NOT intended to be taken as a rule.** Observations of the actual changes on the site as restoration occurs should be conducted on a yearly basis and stocking rate should be recalculated and adjusted accordingly. If a full restoration of the wetlands takes place, this projection will assist in anticipating possible reductions of the forage inventory.

The Recommended Initial Stocking Rate of the ranch in the current state is 2,832 AU. If the south side of grazing unit 86 is not included the adjusted Recommended Stocking Rate is 2,728 AU.

The predicted Recommended Stocking Rate following wetland restoration is 1,701 AU and 1,596 AU with the exclusion of the south portion of Field 86. This is a reduction of 1,132 AU compared to current.

The predicted Recommended Stocking Rate following total restoration of the site is 998 AU and 892 AU with the exclusion of the south portion of Field 86, a reduction of 1,836 AU compared to current. This estimate includes the conversion of non-hydric areas that are currently used to produce improved pasture grasses, to resemble south Florida flatwoods.

The projections shown above are NOT intended for use in developing long range plans and leases, due to the fact that it may take few or many years for the plant communities to change. In addition, the future outcome of the hydrologic restoration activities, weed control, and grazing management may produce significant differences in forage production due to unknown variables. This may result in significant decreases or increases in forage production on some sites.

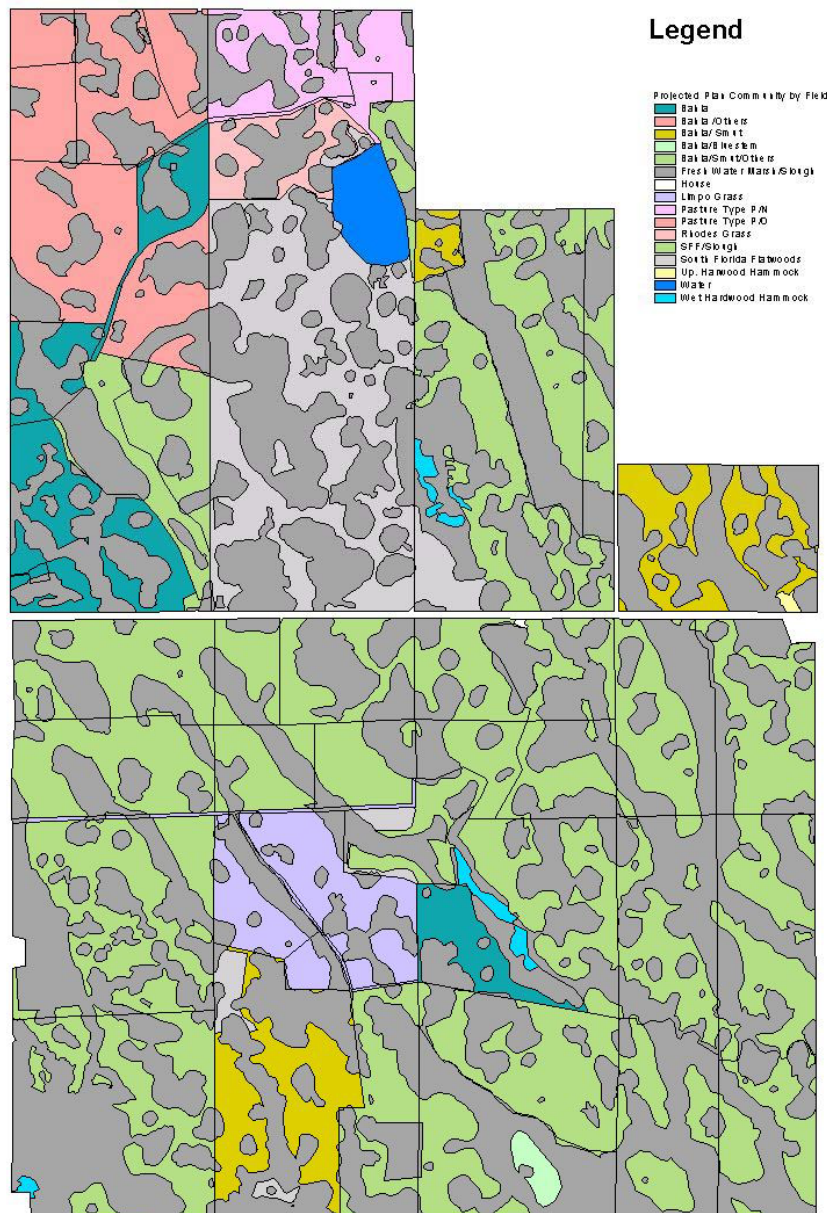
Allapattah Ranch Projected Wetland Restoration

SFWMD

Martin SWCD

Date: 07/18/2002

Ft. Pierce Service Center
USDA-NRCS



4000 0 4000 8000 Feet



Prescribed Grazing Plan

*Prepared for
South Florida Water Management District*

Allapattah Ranch Parcel C

In

Martin County, Florida

In cooperation with

Martin Soil & Water Conservation District

And

*United States Department of Agriculture
Natural Resources Conservation Service*

October 2003



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1. Definition
2. Purpose
3. General Description
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5. Livestock Forage Inventory
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8. Plan Map
9. Recommended Grazing Heights
10. Adjustments To the Grazing System
11. Operations and Maintenance
12. Contingency Management Plan
13. Projected Stocking Reduction Based on Expected Restoration

1. Definition:

Prescribed grazing is a controlled harvest of vegetation with grazing and browsing animals. Prescribed grazing will be used on lands where grazing animals are managed. For this project prescribed grazing will be used as a tool to assist in the restoration of the Ranch, in conjunction with Brush Control, Pest Management, other practices needed to meet the resource concerns and the projected restoration objectives.

2. Purpose:

This practice will be applied as part of a conservation management system to accomplish the following objectives:

- Maintain a stable and desired plant community, improve or maintain the health and vigor of selected plants.
- Maintain or improve water quality.

Note: This plan will be reviewed yearly by the owner/operator. If the number of livestock (10% or more) or the forage condition changes the plan may need to be revised.

3. General Description:

The Ranch is located on Road 714 in Martin County. The area is approximately **2,679 acres** of grazing lands. The property is currently managed as a cow/calf operation. The pastures in their current condition are capable of producing enough forage to support **676 animal units (AUs)**. The system in its present condition can support an average of 676 cows, with an average weight of 1000 lbs.

Since the purpose of the plan is to use the amount of animals that will assist in the management of the site, the plan was developed for Brood Cows in mind. Bulls and Heifers may be included in the herd system as needed as long as the overall suggested stocking rate is maintained. To estimate for Heifers and Bulls use the following AU values. The suggested Bull:Cow Ratio is 1:20.

Cow w/Calf = 1.0 AU

Bull (Mature) = 1.35 AU

Heifer (2 Yr.) = .80 AU

Heifer (4 Yr.) = 1.0 AU

4. Objectives:

The landowner's objectives are to restore the hydrology of the site and eventually restore the wetlands and bring the Ranch to a native plant community. Minimize impacts to the resources, specifically water quality during the restoration process. The objectives of the prescribed grazing plan are to improve or maintain an optimum level of the native forages and assist in the reduction of biomass. The proposed grazing plan considers Livestock health by calculating a stocking rate that is supported by forage inventory performed at the ranch including the suggested season for needed supplements. The profitability of the site as a Cow Calf Operation was not taken into account in this plan and will be to the land user and the SFWMD to determine.

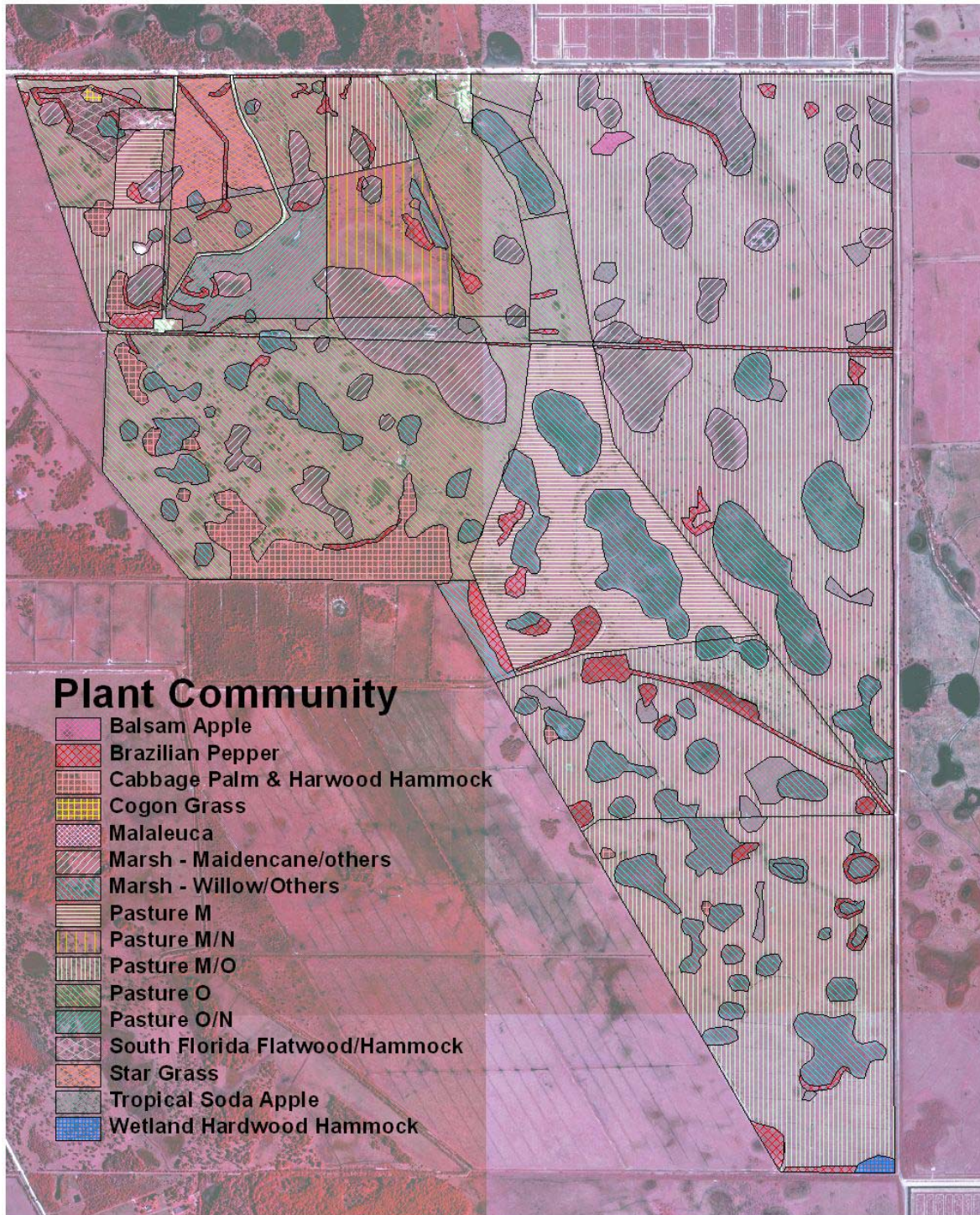
5. Livestock Forage Inventory:

Livestock Forage Inventories are estimates of available forage in each pasture. These estimates are then used to project stocking rates and feed requirements annually. The following Livestock Forage Inventory was evaluated at the time of the development of this plan. Forage will vary due to climatic conditions and management of grazing system. The forage inventory should be evaluated on a regular basis to ensure proper stocking rate according to the goals listed for the site and meet the forage requirements of the livestock.

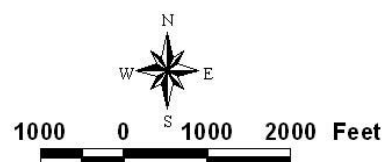
(See Enclosed Forage Inventory)

6. Forage Inventory Map: (See enclosed Plant Community Map)

Allapattah Parcel C WRP Plant Community Map



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South Florida Water Management District
Martin County
July 2003



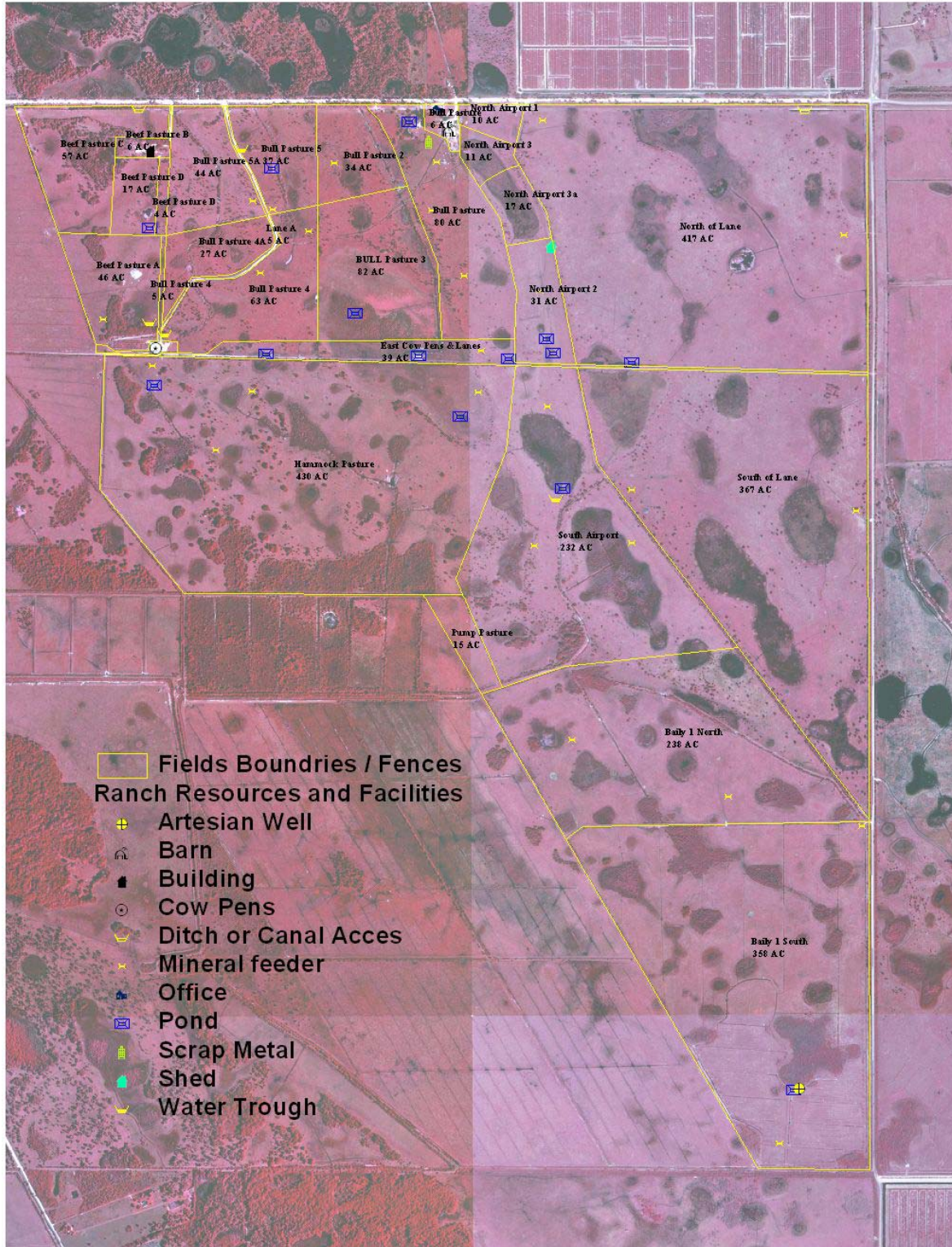
7. Annual Grazing Schedule:

Annual Grazing Schedules are designed to account for variations in the amount and growth of forage due to changes in climatic conditions. The following grazing suggestions should be used as a **guide** only. Actual rotation schedules should be based on amount and conditions of forage in each pasture. Please see section 9 for proper grazing and stubble heights.

Name		Allapattah Ranch WRP Parcel C													
Technician		Ismael Reyes, Resource Conservationist													
Date		Jul-03 12 Months Rotation based on existing fencing and grazing units													
Herd ID and Type	Pasture #	Kind of Forage	Acres	(by months, show planned in and out dates for each herd and grazing unit)											
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
All areas	All	Mainly Bahia, Range Areas	6679	(2-3 herds suggested) to be moved 28 days			Growing Season - allow 14 days rest period. Graze Bahia to minimum stubble of 2 inches. Graze Limpo and similar to minimum stubble of 4 inches. For Range Site use Chalky Bluestem and Maidencane as indicators (graze to 6"-8") (see section 9) (2-3 Herds Suggested for this area)						(2-3 herds suggested) to be moved 28 days		
				Suggested Breeding Period											
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
SUPPLEMENTS *				x	x	x	x	x	x	x	x	x	x	x	x
SUPPLEMENTS- PROTIEIN = X, SALT AND MINERAL = 0															
Notes:															
For Use As A GUIDE ONLY!															
<i>Important: base grazing periods on the forrage plants required on the required stubble heights as shown in the Section 9 of your plan.</i>															
<i>Environmental conditions such as soil moisture, temperature, forage quality, ect, will be consider by the manager when determining actual rotation schedule.</i>															
AU = Animal Units (1000 lbs Cow)															

8. Plan Map:

Allapattah Parcel C WRP Plan Map



USDA Natural Resources Conservation Service
Martin SWCD
South Florida Water Management District
Martin County
July 2003

1000 0 1000 2000 Feet



9. Recommended Grazing Heights and Length of Grazing Periods:

Grazing animals can rapidly and substantially alter the productivity and amount of forage in each pasture. Overgrazing adversely affects forage growth, water and soil conservation, and pasture persistence. Animals will prefer improved forages like the one listed below. Over grazing may induce more use of the wetland areas in some seasons. Under-grazing results in forage waste, reduced quality, and reduced tiller development. Considering that improving existing forages is not a goal for this project, a unique balance may be obtained to ensure a desirable stand of forage and limit grazing on the wetland areas included in the same grazing unit.

The following table lists common forages found in South Florida along with recommended heights to maintain healthy stands of forage:

FORAGE TYPE	Min. Ht. To Begin Grazing	Min. Grazing Ht.
Bahia grass	6"	2"
Limpo grass	12"	4"
Pangola Digitgrass	8"	6"
Maidencane	12"	6-8"
Chalky bluestem	12"	6-8"

Grazing heights for native forage plants is dependent upon the species and the time of year the plant is grazed. For Native Grasses, remove no more that 50% (by weight) of the plant in any grazing event This will provide proper use of the forage while maintaining sufficient plant material to, provide wildlife habitat, protect the soil resource, and maintain the health of the plant community.

Grazing periods should be kept relatively short to prevent the plants from being grazed before they have the opportunity to recover from the last grazing event. This will depend on the size of the herd and the area to be grazed. Use the forage heights shown in the previous table to determine the length of the grazing periods.

Rest Periods should be provided between grazing events to all the plants to recovery from the effects of grazing. The recovery periods should be long enough to allow the forages to reach the Minimum Height to Begin Grazing. Because the rest periods are based on the growth rate of the plants the length of the rest period will vary. The recommended recovery periods are shown in the following table:

Resting Periods Based on Forage Growth Rate			
Forage Type	Forage Growth Rate		
	Fast (June 1-Sept 1)	Moderate (Mar 1-June 1 Sept 1 – Nov 1)	Dormant (Nov 1- Mar 1)
Bahiagrass	14-28 days	28-35 days	35-60 days or more
Limpograss	14-21 days	28-35 days	35-60 days or more
Pangolagrass	7-21 days	21-28 days	28-60 days or more
Maidencane	28-35 days	35-45 days	45-60 days or more
Chalky bluestem	28-35 days	35-45 days	45-60 days or more

10. Adjustments to the Grazing System:

Adjustments in the grazing management system will be necessary during and after restoration and other management activities, such as planting, prescribed burning or pest management. The adjustments will provide a suitable period for the vegetation to recover from the management activity or as dictated by pesticide label restrictions. A deferment from grazing means the complete removal of all domestic animals for the duration of the deferment.

If buffer areas are developed around specific wetlands or other areas within the Ranch during the restoration process, livestock grazing may be permitted during dry periods of the year. This will help to utilize available forages within the buffer and control woody vegetation. Stocking rates should be adjusted to assure that grazing is complete within one week. The minimum grazing heights listed in Section 9 for corresponding grasses shall not be exceeded.

When prescribed burning is applied, grazing shall be deferred as follows:

Improved pasture areas	30-60 days during the growing season (Mar1-Oct1)
Flatwoods	30-90 days during the growing season (Mar1-Oct1)
Fresh Water Marsh and Slough	30-90 days during the growing season (Mar1-Oct1)

Areas that have been disturbed and planted to native vegetation shall be deferred from grazing for a minimum of 1 complete growing season following planting or until the grass is well established and produces seed. Native grass plantings generally require 2 complete growing seasons to become well established. The deferment shall continue until a NRCS Rangeland or Grazing Land Specialist has provided approval. Temporary fences may be used to protect small areas during the deferment period.

Areas that have been mechanically treated for brush control and newly planted areas will be provided a deferment period to allow herbaceous plants to recover. The deferment will be a minimum of 90 consecutive days during the period of March 1 to December 1, unless only spot control was applied.

If herbicides used to control common weeds and invasive species the grazing management will be adjusted to meet the requirements (if any) listed on the herbicide label. Cattle will not be allowed to re-enter the area for the duration shown on the herbicide label.

11. Operation and Maintenance:

The location of mineral and supplement feeders will be moved routinely to evenly distribute grazing animals throughout the pasture. The herd will be rotated to a fresh pasture when the average stubble height falls below the recommended minimum grazing height (See Section 9). When possible, the grazing period should be 14 days or less and the pastures allowed a recovery period of 21 days or until the forage reaches the recommended height to begin grazing (See Section 9).

12. Contingency Management Plan:

Forage supplies will be evaluated weekly to determine if forage supplies and quality are adequate to meet livestock demand. When the forage is not adequate, the grazing system will be adjusted or supplemental feed will be supplied.

When prolonged periods of adverse climatic condition effect the supply of forage, the grazing system and/or stocking rates will be adjusted or additional supplemental feed will be provided.

APPENDIX C

DRAFT

ECOLOGICAL AND WATER QUALITY MONITORING PLAN

FOR THE

INDIAN RIVER LAGOON SOUTH PROJECT

IDENTIFIED AS APPENDIX L (IRL PIR)

**DRAFT
ECOLOGICAL AND WATER QUALITY MONITORING PLAN
FOR THE
INDIAN RIVER LAGOON SOUTH PROJECT**

Introduction.

The St. Lucie Estuary (SLE) and Indian River Lagoon (IRL) have been significantly altered by human activities. These activities include the construction of major canals (C-23, C-24, C-25 and C-44), which rapidly drain their watersheds into the SLE and IRL. Additionally, the C-44 canal provides an outlet for Lake Okeechobee water to be discharged to the SLE. As a result, freshwater inflows are extremely variable and tend to be too great in the wet season to support healthy, sustainable estuarine communities.

Oyster and submerged aquatic vegetation (SAV) beds provide important habitat for numerous organisms and, along with juvenile fishes, are indicators of a healthy estuary. Efforts of the Indian River Lagoon South (IRL-S) Project and the Comprehensive Everglades Restoration Plan (CERP) focus on establishing inflow regimes that will provide appropriate salinity ranges to re-establish and maintain these key organisms in the SLE and the IRL.

The objective of the IRL-S Ecological and Water Quality Monitoring Plan is to determine if restoring beneficial patterns of freshwater flow, salinity, and water quality to the SLE and the IRL will achieve the expected distribution, community structure and viability of SAV beds and oyster bars. The plan will also monitor ecosystem responses to changes in hydroperiod depth and duration within the Natural Storage and Treatment Areas that are expected to provide ecological conditions suitable for expanded and intensified wildlife utilization through an increase in the spatial extent of wetlands, improvements in habitat functional quality, and improvements in native plant and animal species diversity and abundance. In addition, the monitoring should provide information on the engineering components [reservoirs, Stormwater Treatment Areas (STAs), muck removal, and artificial habitats] efficiencies ultimately supporting the adaptive management process.

RECOVER and the CERP Project Delivery Teams (PDTs) recognize that the effects from implementing the CERP projects must be monitored at both system-wide and local scales. Responsibility for the design and implementation of system-wide monitoring is in the hands of RECOVER, while the design and implementation of monitoring to determine local effects and project performance is the responsibility of the individual CERP PDTs. To implement the system-wide program, RECOVER has

developed the CERP Monitoring and Assessment Plan (MAP). This system-wide monitoring plan and the individual project monitoring plans must be closely coordinated to ensure that measures and targets selected by the project teams are consistent with system-wide measures and that duplication of effort is avoided.

The IRL-S Ecological and Water Quality Monitoring Plan will utilize the results of the MAP whenever possible. However, since the MAP is trying to detect system-wide or regional changes, only certain parameters are to be measured. In order to detect project-specific changes, additional parameters and sampling sites will be required and are addressed in this monitoring plan.

The IRL-S Ecological and Water Quality Monitoring Plan is comprised of three monitoring sections, the Ecological Monitoring Plan for the Allapattah Complex and Other Natural Storage and Treatment Areas, the Ecological Monitoring Plan for the St. Lucie Estuary and the Indian River Lagoon, and the Water Quality Monitoring Plan for Reservoirs and Stormwater Treatment Areas. The monitoring plan for the 20,000-acre Allapattah Ranch Natural Area will serve as a pilot project and template for restoration and monitoring activities that are anticipated to occur on the remaining 72,199 acres of Natural Areas within the IRL-S Project. These additional areas have the same goals and objectives for restoration as those of the Allapattah Ranch Natural Area. The ecological communities on these areas are similar to those on the Allapattah Ranch Natural Area, although some land parcels may have either a greater percentage of historic hydric soils (*i.e.*, wetlands needing restoration) or more upland areas (*e.g.*, scrub or hardwood forests). The study team believes that all the activities that would occur on the Allapattah Ranch Natural Area would also occur on the other natural areas. Cost estimates for the other natural areas are provided in the text.

INDIAN RIVER LAGOON – SOUTH PROJECT ECOLOGICAL MONITORING PLAN FOR THE ALLAPATTAH COMPLEX AND OTHER NATURAL STORAGE AND TREATMENT AREAS

Project Description:

The Allapattah Complex - Natural Storage and Treatment Area, shown on Figure 1, is located in Martin County and includes approximately 40,048 acres of land in the C-23 basin. It is bounded on the north by the C-23 Canal and on the south by citrus groves. The Interstate-95 corridor generally bounds the east and the Osceola Ridge forms the western edge. County Road 714 bisects the complex into north and south and County Road 609 (Allapattah Road) bisects the property into east and west. Additionally, two separate Florida Power and Light transmission lines (500 kV and 230 kV) traverse the property from north to south. A Florida Gas Transmission line is also located along the property boundary on the north side County Road 714.

Figure 1. The Allapattah Complex Natural Storage and Water Quality Treatment Area.



The Allapattah Ranch Natural Area is the central component of the Allapattah Complex Natural Storage and Treatment Area. It is approximately 20,000 acres, and is comprised of primarily improved pasture with remnant wetlands and pine flatwoods. This restoration monitoring plan was designed for the Allapattah Ranch Natural Area, and will serve as a template for the remaining Natural Area parcels of the Indian River Lagoon – South (IRL-S) Project. The primary objectives of the Natural Storage and Treatment Areas are:

- To reduce stormwater runoff within the basin via retention of water which allowed a reduction in reservoir size while still achieving the salinity goals for the St. Lucie Estuary
- To reduce nutrient loads to downstream water bodies including the St. Lucie Estuary
- To restore basin storage which will result in a hydrograph that more closely mimics the pre-development hydrograph (*i.e.*, when runoff does occur, releases are small and steady rather than large and brief)
- To provide ecological conditions suitable for expanded and intensified wildlife utilization through an increase in the spatial extent of wetlands, improvements in habitat functional quality, and improvements in native plant and animal species diversity and abundance

The purpose of this monitoring plan is to provide information to adequately address the efficacy of achieving the above stated objectives. Thus, the monitoring plan must generate the types and frequencies of data necessary to adequately evaluate the following:

- A. The quantity of water retained
- B. The quality of water retained
- C. The quantity of water discharged
- D. The timing of water discharged
- E. The quality of water discharged
- F. Ecosystem response to changes in hydroperiod depth and duration (increase in spatial extent of wetlands, increase in habitat value for fish and wildlife)

Relationship of this Plan to the Other Natural Storage and Treatment Areas of the IRL-S Project:

This monitoring plan will serve as a pilot project and template for restoration and monitoring activities that are anticipated to occur on the remaining 72,199 acres of Natural Areas within the IRL-S Project. These additional areas have the same goals and objectives for restoration as those of the Allapattah Ranch Natural Area. The ecological communities on these areas are similar to those on Allapattah Ranch, although some land parcels may have either a greater percentage of historic hydric soils (*i.e.*, wetlands needing restoration) or more upland areas (*e.g.*, scrub or hardwood forests). The study team believes that all the activities that would occur on the

Allapattah Ranch Natural Area would also occur on the other natural areas. Therefore, we are recommending that the costs for Allapattah Ranch tasks be applied on a “per acre” basis for the remaining natural areas. If in the process of restoring and monitoring Allapattah Ranch, the team believes that activities can be scaled back or eliminated, then this per acre cost would be reduced. The current total cost for all monitoring activities on Allapattah Ranch Natural Area is estimated to be:

Year 1 = \$ 682,791
 Year 2 = \$ 171,404
 Year 3 = \$ 171,404
 Year 4 = \$ 171,404
 Year 5 = \$ 254,604

Costs for Years 6 through 9 would be the similar to Years 2, 3 or 4. Cost for Year 10 would be similar to Year 5. Using the current footprint of Allapattah Ranch Natural Area (approximately 20,000 acres), the per acre cost for Year 1 is (\$682,791/20,000 acres) \$34 per acre. For Year 2, the cost drops to \$9 per acre. The Year 1 cost is higher due to the one-time installation costs associated with some of the monitoring equipment. The increase from Year 4 to Year 5 (\$13 per acre) is due to some tasks which are on a 5-year evaluation cycle.

The following table lists the remaining IRL-S Project Natural Areas and their relative sizes (in acres) along with restoration costs, if we conducted all activities similar to those conducted on the Allapattah Ranch Natural Area; keep in mind that all parcels may not be on the same acquisition schedule (i.e., they may not all be acquired in the same year):

Parcel Name	Size	C O S T S P E R Y E A R				
		Year 1	Year 2	Year 3	Year 4	Year 5
Monreve East	2167	73,687	19,503	19,503	19,503	28,171
Monreve West	7012	238,408	63,108	63,108	63,108	91,156
Monreve Ranch	3436	116,824	30,924	30,924	30,924	44,668
Allapattah North	7749	253,266	67,041	67,041	67,041	96,837
Cane Slough #1	3685	125,290	33,165	33,165	33,165	47,905
Cane Slough #2	1954	66,436	17,586	17,586	17,586	25,402
Fox Brown	6430	218,620	57,870	57,870	57,870	83,590
St. Lucie Pinelands	5123	174,182	46,107	46,107	46,107	66,599
Cypress Creek	4740	161,160	42,660	42,660	42,660	61,620
V-2 Ranch	13566	461,244	122,094	122,094	122,094	76,358
Trail Ridge	3860	131,240	34,740	34,740	34,740	50,180
Trail Ridge North	5353	182,002	48,177	48,177	48,177	69,589
Atlantic Ridge	7124	242,216	64,116	64,116	64,116	92,612
Total	72199	2,454,766	649,791	649,791	649,791	938,587

Staff Time Costs:

In developing staffing costs for this monitoring plan we use the more conservative of two approaches. That being, to base activity cost for “number of staff per day” on consultant costs, rather than SFWMD personnel costs (the latter being cheaper). An exception to this was for tasks that we anticipated would be performed by SFWMD staff (e.g., the installation of the rainfall recorder, which has a set cost; see Task I.1.A. below). Staff costs were based on the rate of \$800 per day for a principal investigator, and \$400 per day for a field technician. We assumed that two principal investigators would be needed before field technicians were included in a field crew. The resulting consultant costs were as follows:

1 person = \$800 per day,
2 persons = \$1600 per day,
3 persons = \$2000 per day, and
4 persons = \$2400 per day.

OBJECTIVE I. REDUCE BASIN RUNOFF VIA ON-SITE RETENTION OF WATER

1. Quantity of Water Retained

- A. Rainfall. This is a critical measurement because it provides the theoretical maximum volume of water that can be captured and stored on the property without additional pumping from outside sources. This continuous measure would require the installation of one automatic rainfall recorder on the property south of CR 714 and east of CR 609. The installation cost was estimated at \$5000. Operation and maintenance costs, including data collection and analysis, are estimated at \$3,500/year.
- B. Surface Water Extent. This is a critical measurement because it provides the maximum storage potential of the wetlands and yields the hydrograph for determining subsequent releases of surface flows, infiltration, and evapotranspiration. (Measures B, C and D will be tracked using digital stage recorders for hydroperiod depth and duration, which can translate into surface water extent. A total of 9 digital stage recorders (cost \$20,000 each for a total of \$180,000 for equipment and installation) are proposed for the property. Four will be installed within the existing north/south drainage ditches that are proposed to remain. Three of these four will be immediately upstream of the water control structures and allow calculation of flows discharging from the property accounted for under Task I.2.A (quantity of water discharged). The fourth will be placed at the southern end of the property to help determine the backwater effect of the water control structures and allow adjustment of the water control structures as necessary to prevent flood impacts. Four recorders will be placed internally on the property within slough or wetland systems to provide a record of hydroperiod depth and duration. An additional recorder will be placed upstream of the discharge from Parcel C at the corner

of CR 609 and CR714. Operation and maintenance costs, including data collection and analysis, were estimated at \$3,500/recorder/year.

- C. Depth. Depth is a critical measurement because it indicates the type of ecological wetland community that will develop and will be a gauge for restoration success. It will be measured with the digital stage recorders. Cost for this task is included with Task I.1.B.
- D. Evapotranspiration. Evapotranspiration is the mechanism producing the most significant loss of water during the dry season and is critical to a natural recession of surface waters that serves to concentrate prey for wading birds. Evapotranspiration will be estimated post restoration with a model that uses surface water extent, rainfall, and data from existing meteorological stations, and is anticipated to cost \$3,000.

2. Quantity of Water Discharged

- A. Surface Flow. Surface flow from the property will be continuously measured using digital stage recorders (see Task I.1.B) at the two major outfall weirs that are not influenced by adjacent property. Installation cost is estimated at \$40,000 and is included in the estimate outlined in task I.1.B). Operation and maintenance costs, including data collection and analysis are estimated at \$3,500/recorder/year.
- B. Groundwater Flow. Ground water loss to major adjacent canals via subsurface flow and seepage is a potentially critical source of nutrients. The U.S. Army Corps of Engineers (USACE) will use a groundwater model to determine expected groundwater flow rates. If the volume of flow is shown to be greater than 15% of the total water discharged from the property, shallow ground water wells will be installed to monitor ground water quality. The installation cost is \$1000 per well. The operation and maintenance costs for the wells are inconsequential.

OBJECTIVE II – REDUCE NUTRIENT LOADS TO DOWNSTREAM WATER BODIES INCLUDING THE ST. LUCIE ESTUARY

1. Quality of Water Retained

- A. Water Quality. Collect grab samples twice monthly at three internal marsh areas which currently hold water and are expected to continue to hold water as restoration progresses. Analyze for nutrients (total phosphorus, total kjeldahl nitrogen, total nitrite, total nitrate, and total ammonia), hardness, conductivity, dissolved oxygen, water temperature, and pH. Total cost for this task is combined with costs for Tasks II.2.A, II.2.B and

II.2.D, as outlined in Sub-Appendix 2. Total cost for these tasks is \$64,200 per year.

- B. Fish Tissue. Annual collection of fish tissue for total mercury and organochlorine pesticides analyses from the sub-waterbody at each of the three water quality monitoring sites plus an additional 4th site (yet to be determined). Total annual cost for collection of fish tissue and mercury analysis is \$3,228. The additional cost for organochlorine pesticide analysis is \$420/sample. This would add \$3,360 for a total annual cost for these tasks of \$6,588. In accordance with the CERP Guidance Memorandum, this sampling would be dropped or reduced in frequency if sampling results did not exceed baseline concentrations after Year 3, following construction and rehydration.
1. Sample of at least 100 mosquitofish should be collected and physically composited for a single analysis of total mercury from each location during the first week of July (*i.e.*, one month after the start of the rainy season, when maximum mercury sediment concentrations are expected).
 2. If available, five individual whole sunfish (of the same species) should also be collected from each of the 4 locations and analyzed for total mercury.
- C. Sediment Quality. If fish tissue concentrations exceed criteria set forth in the mercury monitoring CERP Guidance Memo, then 3 composite sediment samples (comprised of 3 subsamples each) will be collected at the same locations of the fish tissue sampling. Total maximum cost if all four sites needed to be sampled would be \$8,050 per year.

2. Quality of Water Discharged

- A. Water Quality Composite Sampling. Installation of flow-weighted auto-sampling devices at two (2) discharge sites. Flow-weighted samples will be collected twice per month and analyzed for total phosphorus, total kjeldahl nitrogen, total nitrite, total nitrate, and total ammonia. Total cost for this task is included in cost for Task II.1.A. (See above) as outlined in Sub-Appendix 2.
- B. Water Quality Grab Sampling. Collect grab samples twice monthly from 2 discharge locations. Analyze for nutrients (total phosphorus, total kjeldahl nitrogen, total nitrite, total nitrate, and total ammonia), conductivity, hardness, dissolved oxygen, water temperature, and pH. Total cost for this task is included in cost for Task II.1.A. (See above) as outlined in Sub-Appendix 2.
- C. Nutrient Reduction Evaluation. Determine nutrient reduction trends using sample and flow results. Total cost for this task is based on SFWMD staff time and would approximate \$2400.
- D. Ground Water Quality. Ground water loss to major adjacent canals via subsurface flow and seepage is a potentially critical pathway for nutrients to get into the estuary and lagoon. If the volume of ground water flow is shown

to be greater than 15% of the total water discharged from the property, shallow ground water wells will be installed to monitor ground water quality. The wells will be installed at a spatial distribution of one site per mile of canal on the northern boundary of the property (at C-23) and monitored twice per month for nutrients (total phosphorus, total kjeldahl nitrogen, total nitrite, total nitrate, and total ammonia). Annual data collection and analysis costs are included with Task II.1.A (as outlined in Sub-Appendix 2)

OBJECTIVE III. AFFORD BASIN STORAGE WHICH MORE CLOSELY MIMICS PRE-DEVELOPMENT HYDROPERIOD

1. Hydrograph

Compare the current hydrograph to restored stage duration and discharge hydrograph (see Tasks I.1.A. through I.1.D, above). This task involves the review of stage recorder data and hydrograph construction. Total cost for this task is based on SFWMD staff time and would approximate \$3000.

OBJECTIVE IV. PROVIDE CONDITIONS SUITABLE FOR EXPANDED AND INTENSIFIED WILDLIFE UTILIZATION

The most appropriate parameters for monitoring of the IRL-S natural storage and water quality treatment areas are those dealing with wetland restoration and the response of wildlife to those habitat changes. It is assumed that in addition to restoration of hydrology, the natural storage and water quality treatment areas will benefit through comprehensive habitat management of both wetland and upland communities (e.g., exotics, fire, and cattle grazing).

Many of the previously mentioned measures will support enhanced wildlife usage on the Allapattah Complex. Sub-objectives that would support this objective are:

- An increase in the depth and duration of on-site wetland hydroperiod
- An increase in the spatial extent and diversity of native submerged, emergent and upland plant communities
- A reduction or elimination of exotic plant species
- An increase in diversity and abundance of aquatic benthic invertebrates
- An increase in the diversity and abundance of native fish, amphibians, reptiles and small mammals
- An increase in the size and number of foraging flocks of wading and water birds in wetlands
- An increase in the number of nesting trees for wading birds
- An increase in wetland and upland habitats for passerine birds
- An increase in wetland and upland habitats for large carnivores

- An increase in pine flatwoods habitat suitable for red cockaded woodpecker
- An increase in the nesting and foraging habitat for sandhill and whooping cranes
- An increase in the nesting and foraging habitats for caracara, bald eagle and other raptors
- An increase in habitat for game species such as turkey and whitetail deer

The tasks in Objective I will indicate the increase in the depth and duration of on-site wetland hydroperiod following restoration. The following criteria will be used to indicate the types of ecological communities that are expected as hydroperiods are restored.

- A. Mesic Flatwoods: no surface water except during storms
- B. Dry Prairie: surface water for one month during wet season or El Nino winters with a maximum depth of 6 cm
- C. Hydric Flatwoods: visible surface water for 60 to 120 days per year with a maximum depth of 30 to 60 cm
- D. Wet Prairies: visible surface water for 50 to 150 days per year and a maximum depth of 25 to 30 cm
- E. Bay Swamps: visible surface water for more than 6 months per year and maximum depths ranging from 15 to 30 cm.
- F. Freshwater Marshes: visible surface water for more than 6 months per year and maximum depths ranging from 30 cm to 1 meter or more.

1. **Baseline monitoring for listed plant surveys.** Conduct one-time, baseline vegetation transect survey in all habitat types for federally and state-listed plants over a 5-day period twice a year during the appropriate season (see Sub-Appendix 1; Section K). Cost for 10 days @\$1600/day (2 staff) is \$16,000 per year. Vehicle rental cost is \$68/day. Total cost for this task is \$16,680.

2. **Wetland character and vegetative responses to rehydration (semi-Quantitative).**

- A. Localized mapping. Conduct an annual on-site GIS mapping of areal extent of major taxonomic groups (e.g., sawgrass, cattail, maidencane, pickerelweed, corkwood, exotics, etc) at 6 representative wetland sites for the year prior to construction and the 5-year interval following construction. This monitoring is required to verify the temporal and spatial lags in habitat unit lift (as described in the Project Implementation Report) as wetlands are restored. Cost for field work (@ 1 day for 2 staff) is \$1600/day. GIS work (@ 1 day for 1 staff) is \$800/day. Transportation and equipment costs are \$130/day. Total cost = \$2530 per year.
- B. Aerial Photo Interpretation. Conduct baseline (i.e., pre-construction) and post-construction monitoring of wetlands using aerial photo interpretation and mapping at 5-year intervals over the entire site using DOQQ (Digital Ortho

Quarter Quadrangles) at a scale of 1:24,000. There is no cost for photography since we will utilize existing SFWMD photography. Cost for photo-interpretation is \$40,000 per event.

- C. Photopoint monitoring. Establish a permanent photopoint monitoring station at 20 selected wetland areas and photograph annually. Six of these will be the same as those identified in Task IV.2.A above. The desired result is to be able to identify an increase in spatial extent and diversity of native wetland vegetation in response to increases in hydroperiod depth and duration appropriate for the targeted wetland type, and a decrease in exotic plant species - measured in acres or hectares. Costs for installation of permanent photopoint and protective cattle fencing were estimated at \$200/station (total installation cost is \$4000). Total annual photography cost (based on 2 field days per year) is \$1600 per year.
- D. Wetland Rapid Assessment Procedure (WRAP). Conduct pre-construction and 5-year post-construction WRAP for wetlands; (pre-construction will be for entire property at a cost of 1.8 days per 1000 acres for 3 field staff; post-construction would be for a subset – i.e., 20% of the wetlands on the property. The desired result would be an increase in functional value of wetland and upland ecosystems based on vegetation structure appropriate for the targeted wetland type. Wetland WRAP costs for pre-construction = 1.8 days/1000 ac x 20,000 acres = 36 days. 36 days x 3 staff = 108 staff-days @ \$2000/day = \$216,000. Post-construction follow-up (at 20% effort) would cost \$43,200 per event.

3. An increase in diversity and abundance of aquatic benthic invertebrates

- A. Baseline monitoring. Collect annual macroinvertebrate samples from a 100-meter radius internal wetland site (Graves et. al. 1998; at the same sites where water quality is monitored) utilizing the 20 dipnet sweep method, composited, and randomly subsampled to 300 individuals (FDEP 1996, Doberstein et. al. 2000). Three different wetland sites per each wetland type (e.g., wet prairie, freshwater marsh, bay swamp, wet flatwoods, etc) present on the property will be sampled 4 times for the first year of baseline monitoring. Cost is \$550 for sample collection and analysis. Total cost for baseline is: 12 sites x 4 samples per year x \$550 = \$26,400 per year.
- B. Follow-up monitoring. The baseline data will be evaluated by FDEP to determine if the sampling frequency and locations are appropriate or should be scaled back. Otherwise, the methods, locations, and cost will be the same.

4. Bird monitoring

- A. Baseline monitoring.
 - 1. Baseline surveys will be conducted for federally-listed bird species (e.g., Audubon's crested caracara, grasshopper sparrow, bald eagle, wood stork, red-cockaded woodpecker, scrub jay, and snail kite) in

the appropriate habitats over the entire site (See Sub-Appendix 1 for sampling protocols). Survey cost for all species combined would be \$63,724. However, at this time it does not appear that scrub jay or red-cockaded woodpecker surveys are needed on Allapattah Ranch Natural Area. Therefore, the cost for the other baseline, listed bird surveys would be reduced to approximately \$45,036.

2. A baseline survey for state-listed (*e.g.*, burrowing owl) and other bird species will be conducted prior to construction activities. Costs are included in the general fish and wildlife baseline surveys (Tasks IV.5.A. and IV.6.A.) which total \$51,720 per year.

B. Follow-up monitoring.

1. Follow-up surveys will be conducted as needed depending on construction or management activities, such as burning, for federally-listed species (See Sub-Appendix 1 for sampling protocols). Survey costs are species specific; however, if all species needed to be re-surveyed, the maximum cost would be \$45,036 per year.

2. Follow-up surveys (as needed depending on construction or management activities such as burning) will be conducted for state-listed species (at this time, burrowing owl is the only avian species of concern). Cost would be based on 1 staff per day per event (or \$800 per survey).

5. Fish Monitoring

A. Baseline monitoring. A baseline survey for fish species will be conducted prior to construction activities. Costs are included in the general fish and wildlife baseline surveys (Tasks IV.4.A. and IV.6.A.) which total \$51,720 per year.

B. Follow-up monitoring. During the fish tissue sampling for mercury analysis (see Section II.1.B.), a fish species list and respective relative abundances will be recorded. This information will serve to guide future community-level monitoring efforts, if desired, and additional mercury monitoring in other trophic levels (*e.g.*, largemouth bass, wading birds, alligators). The cost for this monitoring is included with the cost for Tasks II.1.B.1. and II.1.B.2. The desired result is an increase in fish abundance and diversity in wetlands, and no loss in fish abundance or diversity outside of natural variation.

6. Reptile, amphibian, and small mammal monitoring

A. Baseline monitoring. A baseline survey will be conducted prior to construction activities for reptile, amphibian, and small mammal species. Costs are included in the general fish and wildlife baseline surveys (Tasks IV.4.A. and IV.5.A.) which total \$51,720 per year. The desired result is an increase in abundance and diversity, and no loss in abundance or diversity outside of natural variation.

- B. Gopher Tortoise Surveys. Baseline and follow-up surveys (as needed depending on construction or management activities such as burning) will be conducted for gopher tortoise. Survey costs are based on evaluating 15% of the appropriate habitat (uplands). Fifty acres can be surveyed by one person in one hour (walking 6 transects of 1.2 acres each). Therefore, in an 8-hour day, one person can survey 400 acres (*i.e.*, 15% of 400 acres). For Allapattah Ranch, if roughly half of the site is now uplands, then a typical gopher tortoise survey could take up to 25 days for one person [assuming that all uplands (approximately 10,000 acres) are suitable tortoise habitat – in reality it is probably much less]. A maximum cost of \$2000 per day for 3 people would total \$16,667 if all 10,000 acres needed to be surveyed.

Literature Cited

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Florida Department of Environmental Protection. 1996. Standard operating procedures for biological assessment. FDEP Biology section, Tallahassee, Florida. 64 pp.

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Appendix L: Sub-Appendix 1

Inventory Activities (Baseline Surveys for Listed Species and General Fish and Wildlife)

Before a restoration monitoring plan can be developed and implemented, an inventory of existing conditions is needed. Some of these inventory activities will lead to monitoring tasks (e.g., a vegetation inventory of a restorable wetland remnant could lead to the placement and monitoring of vegetational transect along a hydric-upland gradient). Other inventory activities will yield only baseline data (e.g., topographic surveys, or surveys for federally listed species) that may support other inventory or monitoring tasks or be required solely to meet regulatory requirements.

1. Federal Threatened and Endangered Species Surveys (protocols excerpted from the U.S Fish and Wildlife Service's Standard Local Operating Procedures for Endangered Species)

The following discussion outlines the federally listed threatened and endangered species that may be present in the IRL-S Feasibility Study Natural Storage and Water Quality Treatment Area Components, and their respective survey protocols (where appropriate).

A. Audubon's Crested Caracara

Historically, the threatened Audubon's crested caracara [*Polyborus (=Caracara) plancus audubonii*] was a common resident in Florida from northern Brevard County, south to Fort Pierce, Lake Okeechobee, and Hendry County. Today, the region of greatest abundance for this large raptor is a five-county area north and west of Lake Okeechobee. It is known to inhabit St. Lucie and Martin counties, but the exact locations of nests and foraging habitat are poorly documented. The preferred habitat is dry or wet prairies with scattered cabbage palms (U.S. Fish and Wildlife Service 1999).

Crested caracaras prefer to nest in cabbage palms (*Sabal palmetto*) surrounded by open habitats with low ground cover and a low density of tall or shrubby vegetation. They generally construct a new nest each season, often in the same tree as the previous year. The nesting season may run from September through June with the majority of the nesting activity occurring in the months of November through April. During the nesting season, crested caracaras spend most of their time within a core area with a radius of approximately 1,000 meters (3,300 feet). The core area is strongly defended by the nesting pair during the nesting season (Morrison 1997a). Nesting crested caracaras are susceptible to disturbances that alter the existing levels or patterns of activity present around the nest tree. Observations of nesting caracaras by Morrison (2001) note that the birds will generally flush from the nest during incubation or early nestling stages if the source of the disturbance is within 300 meters (985 feet) from the nest tree.

For purposes of assessing levels of adverse effects to nesting crested caracaras, two zones are recognized by the Fish and Wildlife Service as being critical for conservation and recovery of the species. These are the primary zone and the secondary zone. The primary zone radius is the 300 meter (985 feet) flushing distance from the nest. The secondary zone radius is the 2,000 meter foraging territory in which the nest is located. Restrictions in the secondary zone are necessary to minimize disturbances that might compromise the integrity of the primary zone as well as to protect key areas outside of the primary zone.

Searching for Nests

Crested caracaras are very site faithful, even to particular nest trees. Nest trees are generally cabbage palms over 5 meters (16 feet) in height; have large, full closed crowns; and are typically on the southeastern to southwestern edge of a group of trees. Nests may also be in lone, freestanding palm trees, in groups of two to ten palms, or (rarely) in tall, emergent palms in the middle of a large hammock. Oaks and cypress trees may also be used for nesting, but are likely to be used only if few palms are available within a large area of otherwise suitable pasture and wetland habitat (Morrison 1997b).

To survey a site for crested caracara nests, first map out all the freestanding palm trees, cabbage palm hammocks and other tree groupings, then search each of these trees on foot or by vehicle. Most of the time, a nest can be easily seen from the base of the tree. Chicks can often be heard begging, as well. Other observable signs that a nest is active include feces and prey remains below the nest tree, chicks calling from the nest, or defensive behavior by the adults when the observer is near the tree.

Other observed behaviors of adult birds can be used to find nests. During incubation, the adult not currently incubating often will perch high and visibly in a tall tree within 300 meters (985 feet) of the nest. Adult crested caracaras exhibit little defense behavior near their nest, but if the chicks are large (5 to 8 weeks), adults may remain close to the nest and exhibit rattle and cackle vocalizations and the head-throwback display (Morrison 1996). Nest searching using playback tapes, a technique used successfully for surveys of other raptors, is not likely to be effective for crested caracaras because they do not respond to such tapes.

Timing of Surveys

Breeding activity can occur from September through June with the primary season being November through April. Peak egg laying occurs from late December through early February (Morrison 1999). The post-fledging dependency period is approximately 8 weeks. Therefore, surveys for territory occupancy or to find new breeding pairs are best conducted during the months of January, February, March, and April when nesting within the overall population is at its peak and adults are most likely feeding nestlings (Morrison 2001). Since crested caracaras are most sensitive during the nest building, incubation, and early nestling stages of the nesting cycle, surveys made earlier than

January, *i.e.*, December, may unduly disturb the birds and result in nest abandonment. Crested caracaras can also be observed in the territory after the chicks fledge from the nest. The peak of fledging for the central Florida population occurs during March and April.

Surveys are best conducted early in the morning or late in the afternoon. Crested caracaras are most actively nest building, foraging, or feeding young between sunrise and about 1100 hours, and again, between about 1600 hours and sunset. Crested caracaras are rarely active during the heat of midday, especially in the summer months. The Service does not recommend surveys in December and surveys conducted during other times of the year may be inconclusive.

Duration of Survey

When surveying for crested caracara nests in areas where the nest site is not known, observers should search all freestanding palm trees, cabbage palm hammocks and other tree groupings once a day for three consecutive days. The 3-day search should be repeated again in 2 weeks and again in 4 weeks. Generally, three observation periods are sufficient to assess crested caracaras presence and activity pattern.

Foraging Patterns

Following the nest tree searches, the observers should remain in the area for a minimum of 3 hours to observe crested caracara movements in the project area. Observations should be conducted from a position where a large area of suitable habitat can be viewed. The observer should note flight directions, roost trees, foraging habits, territorial aggression displays, nest building behavior, and general site disturbance levels. The emphasis in these observations is to determine the ambient conditions within the home range of the resident crested caracaras. Because crested caracaras are sensitive to human intrusions into their home ranges, the causal observations should be conducted from cover, such as a vehicle, so that disturbance to the pair can be minimized.

Reports

The key end products of this procedure should include:

1. A complete count of all crested caracara nesting pairs within the project area; and
 2. An approximate territory map or home range for each nesting pair.
- A. Field data sheets should include:
1. Dates with starting and ending times of all surveys conducted;
 2. Weather conditions during all surveys, including average temperature, wind speed and direction, visibility, and precipitation; and
 3. Total number of crested caracara nests found and number of crested caracaras observed in each location.

- B. The report should also include an aerial photograph or vegetation map depicting:
1. The entire area of interest;
 2. Nest locations, primary and secondary zones;
 3. Habitat descriptions; and
 4. Locations of all crested caracaras seen or heard while conducting the survey or at any other time, including flight direction.

B. Bald Eagle

The threatened bald eagle (*Haliaeetus leucocephalus*) is considered common and known to breed throughout the state. Nest sites are usually located near large rivers, lakes, or estuaries where they feed primarily on fish and water-dependent birds. Their distribution is influenced by the availability of suitable nest and perch sites near large, open waterbodies, typically with high amounts of water-to-land edge (U.S. Fish and Wildlife Service 1999). Bald eagles could be encountered during construction on this site; therefore, the Service expects implementation of the standard construction precautions to avoid adverse effect on this species.

In evaluating project effects to bald eagles in Florida, the Service views all primary and secondary protection zones as 750 feet and 1,500 feet outward from the nest tree, respectively. On the project maps, determine the boundaries of the project and a 1,500 foot radius surrounding the project boundaries. To determine the presence or absence of a bald eagle nest, check the Florida Fish and Wildlife Conservation Commission's (FWC) data base for known nest sites. The FWC conducts annual aerial surveys for bald eagle nests throughout Florida. The database is available on the FWC web site at <http://wld.fwc.state.fl.us/eagle/default.htm>.

To determine if unrecorded nests are present in the project area, the Service recommends that any forest canopy that is within 3 km of open water, which includes borrow pits, lakes, rivers, and large canals be inspected for nesting raptors. Based on recent experiences with bald eagles also nesting on cell, radio, television, and power transmission towers, the Service also recommends that such structures within the 1,500-foot radius surrounding the property also be checked.

Nest surveys must be conducted during the bald eagle nesting season, which is considered, for Florida, to be from October 1 through May 15. Two survey events are recommended with the events spaced by a two week interval. The survey protocol is a random pedestrian survey beneath the forest community that provides a thorough visual observation of the tree canopy. All observed nests, *i.e.*, eagle, osprey, hawk, heron, owl, or stork, should be located and recorded. Note the locations, with GPS coordinates on the site survey maps with a determination, if possible, of nesting species. The finding of bald eagle nests, active or inactive, may trigger certain restrictions within the primary and secondary zones. Consult with the Service for those restrictions.

C. Florida Grasshopper Sparrow

The Allapattah Ranch Natural Area is outside of the known historical range of the Florida grasshopper sparrow (FGS). However, land activities on the site such as draining and ditching of wetlands have created drier than normal conditions. These conditions may have attracted FGS to the site. Therefore, the site should be surveyed to confirm the presence or absence of this endangered species.

FGS tend to be very secretive and quiet, and almost seem to disappear completely at certain times of the year. They may be easily overlooked when surveys are not during the peak breeding season. Males vigorously defend the boundaries of their territories from the time territories are established through incubation. FGS nest from March through September with the peak nesting activity occurring between early April and late June. FGS may produce two broods in a single season (Stevenson and Anderson 1994, Nicholson 1936). Therefore, the optimum time to survey for FGS is between the months of April and June and the most effective method for surveying a site is to traverse the area systematically, using a high quality tape recording of FGS territorial vocalizations. The recording should include clear examples of all typical territorial calls.

Habitat for the FGS has been described as dry prairie vegetation that is relatively open and low in stature. The habitat consists of treeless, relatively poorly-drained grasslands that have a history of frequent fires (Service 1988, Delany 1996a). The prairie vegetative community is typically dominated by saw palmetto (*Serenoa repens*) and dwarf oaks (*Quercus minima*) ranging from 30 to 70 cm in height. Bluestem grasses (*Andropogon* spp.), St. John's wort (*Hypericum* spp.), and wiregrasses (*Aristida* spp.) are also components of grasshopper sparrow habitat (Delany *et al.* 1985, Service 1988).

Although this description accurately describes FGS habitat, it may be more appropriately considered as a description of the optimal vegetative community for FGS. Sparrows often occur in conditions that are sub-optimal. Recent survey efforts on public lands have shown that FGS also reproduce successfully in pastures that are overgrown or ungrazed (Service 1999). In these cases, sparrows seem to prefer pastures that are not bahia monocultures, but instead have some other species (usually low forbs and shrubs). These other species appear to provide some structural diversity to the prairies. However, as pastures become heavily grazed, sparrow populations decrease or disappear (Delany and Linda 1994). The Service considers an average home range for a breeding pair (singing male) to be an area with a radius of 100 meters (3.1 hectares - 7.8 acres) with the location of the singing male as the center of the territory.

Survey Protocol

Determining whether to conduct sparrow surveys based on perceived habitat quality should be avoided. Within the counties where FGS are known to occur, surveys should be conducted within almost any non-forested habitat, including pastures. An exception

would be row-crops and cleared sites devoid of vegetation, which would not offer suitable conditions for FGS.

The recommended survey protocol is a three-event survey during the nesting season (April 1 through June 15). Minimum time frame between events is two weeks. Surveys outside of the nesting season window may be nonconclusive. The survey protocol should follow the following steps.

1. Identify all patches of prairie-like habitat (un-forested sites with some grass cover), regardless of perceived habitat quality.
2. Establish a survey grid with survey points throughout potential habitat such that points are approximately 200 meters (650 ft) apart. A distance of 200 meters between transects and between stations is generally adequate when using a good-quality, hand-held cassette player broadcasting at full volume. The volume of the cassette player must be sufficient to hear the tape call from a distance of 100 meters.
3. Record all survey point locations in the field (using GPS).
4. Survey point locations using tape-recorded grasshopper sparrow songs. At each point:
 - A. Watch and listen for one minute for any grasshopper sparrow activity,
 - B. Play tape for 30 seconds, watch and listen for one minute, rotate direction 90 degrees, play tape for 30 seconds, watch and listen for one minute, rotate direction 90 degrees, play tape for 30 seconds, watch and listen for one minute, rotate direction 90 degrees, play tape for 30 seconds, watch and listen for one minute,
 - C. Move to next station.
5. Conduct the survey only during accepted survey and monitoring periods.
 - A. Surveys must be conducted between April 1 and June 15.
 - B. Start surveys no earlier than 15-30 minutes before sunrise and end no later than three hours after sunrise. Only morning surveys are acceptable.
 - C. Surveys must be stopped if winds exceed 15 mph.
 - D. Surveys should be conducted by personnel familiar with grasshopper sparrow habitat needs and requirements and are capable of identifying and locating sparrows based on either song or sight.
6. Record dates and times of all surveys by point, and all survey results (include negative results).

Population Size

The intent of the above survey protocol is not to determine the total number of sparrows in an area or on a particular site. Instead, it is intended to detect the presence of a population of sparrows that may be using an area. If sparrows are detected, more

intensive surveys are necessary to determine the number of birds and extent of the area that is occupied.

Once sparrows are determined to be present, the next goal is to determine the extent of area occupied and an estimate of the number of sparrows present. Points where sparrows were observed on initial surveys should be re-surveyed three times during the appropriate period and conditions, but without use of a tape. Observers should record the number of male sparrows singing at each point, and the position of the sparrow observations relative to the point. In addition, all survey points within an 800-meter radius of a survey point where a sparrow is observed should be re-surveyed three times without the use of tapes. The re-surveys can be conducted during consecutive days, local weather conditions permitting.

Reports

The key end products of this procedure are:

1. A complete count of all FGS within the project area; and
2. An approximate territory map or home range for each male sparrow.

A. Field data sheets should include:

1. Dates and starting and ending times of all surveys conducted;
2. Weather conditions during all surveys, including average temperature, wind speed and direction, visibility, and precipitation; and
3. Total number of FGS found and number of FGS territories.

B. An aerial photograph or vegetation map depicting:

1. The entire area of interest;
2. Male FGS locations, territory boundaries, and habitat descriptions; and
3. Locations of all FGS seen or heard while conducting the survey or at any other time, including flight direction.

D. Red-Cockaded Woodpecker

South Florida contains significant support populations for recovery of the endangered redcockaded woodpecker (*Picoides borealis*) in the southeastern United States. Individuals have been found on the Atlantic Ridge Ecosystem CARL (Conservation And Recreation Lands) Project, and "The Reserve" site (the Reserve Development of Regional Impact site). We expect them to also occur in other remnant pine flatwoods in the study area, but private properties have been infrequently surveyed for their presence. Pine stands, or pine-dominated pine/hardwood stands, with a low or sparse understory and ample old-growth pines constitute primary nesting and roosting habitat (Service 1999).

The red-cockaded woodpecker (RCW) is the only North American woodpecker, which excavates its roost and nest cavities in living trees. Cavities are typically excavated on the west to southwest side of a mature pine tree. The mature pines are generally

infected with red-heart fungus (*Phellinus pini*). Red-heart fungus is a slow growing fungus and generally requires 12 to 20 years from inoculation to the decay of sufficient heartwood to facilitate the construction of a cavity. Once a cavity is completed, small, conical “resin wells” are excavated above, alongside, and below the cavity, as well as on the opposite side of the tree. Resin wells are continuously maintained to sustain sap flow for the life of the tree. The resin flow gives the tree a glazed, “candle-like” appearance, which makes it unmistakable as an RCW cavity tree. RCW also chip away the bark from the immediate vicinity of the cavity, creating a smooth, reddish area on the tree, referred to as a “plate.” The nesting season in Florida is late April through early June (April 15 through June 15).

Cavity Construction

Pine stands, or pine-dominated pine/hardwood stands, with a low or sparse midstory and ample old-growth pines, constitutes primary RCW nesting and roosting habitat. RCW will abandon otherwise suitable nesting/roosting areas when sufficient numbers of nesting and roosting cavities are no longer present and/or when the midstory approaches cavity height. Nesting and roosting cavities are typically constructed in old pines, generally those older than 60 to 80 years, with a minimum of 6 inches of heartwood. Cavity excavation may take as long as 10 to 13 years or as short as one to two years, with an average time of 6 to 9 years.

In southwest Florida, mature slash pine trees of sufficient age and heartwood diameter generally have an 8 to 9 inch diameter at breast height (dbh) and a 60 to 65-foot-tall canopy. Mature slash pine trees suitable for RCW cavity construction in southeast and southcentral Florida (St. Sebastian River State Buffer Preserve and Three Lakes Wildlife Management Area, respectively) generally have a 14 to 16 inch dbh and a 110-foot-tall canopy. The southwest Florida slash pines are generally found in hydric soil conditions, whereas, the southeast and southcentral slash pines are in mesic soil conditions.

Survey Protocol

The survey protocol for RCW requires both parallel transect surveys and meandering transect surveys. Surveys are necessary to determine the presence/absence of cavity trees, cavity tree activity level, and foraging area. For survey protocol purposes, the Service considers the average foraging territory for RCW in southern Florida to be approximately 500 acres or a one-half mile radius around the center of the nesting and roosting colony cluster. The Service considers the nesting and roosting colony cluster to be a circular area with its center point the primary nesting cavity. The boundaries of the cluster must include all cavity trees, active or not, a buffer of 200 feet, and encompasses a minimum area of 10 acres.

Suitable Habitat

Because RCW may forage and roost in both pine and pine/hardwood mixed communities, the Service considers suitable RCW habitat to include any forested community that includes pines in the canopy structure. Since RCW generally require contiguous pine or pine/hardwood forested communities for foraging and nesting, isolated forested communities of less than 10 acres need not be surveyed. For survey protocol purposes, an isolated forested community is one that is separated from larger continuous stands by a treeless habitat of 300 feet in width.

Cavity Tree Survey

The most effective cavity tree survey technique for RCW involves the use of parallel pedestrian transects. Pedestrian transects should pass through all potential RCW habitats present on the site to allow sighting of cavities, start holes, and individual birds. The distance between transects should be spaced according to the limits on visibility imposed by vegetation and terrain. Typically, transects spaced 200 feet apart are acceptable, except for areas of dense midstory or exotic plant invasion. Field personnel should establish parallel line transects spaced so that all potential habitats are surveyed. Transect length and distances between transects will vary with size of the area, topography, and vegetative structure. All transects should be individually labeled on a map of the project. Surveys for RCW cavity trees may be performed throughout the year.

Cluster Activity Surveys

Surveys for RCW cluster activity can only be conducted during the breeding season, which is from April 15 through June 15. Surveys to determine cavity tree activity should be conducted during the morning hours, from 1 hour prior to sunrise to four hours past sunrise, on calm, clear days. Cavity trees should be categorized as active, inactive, or abandoned based on appearance, and survey of clan activities on the site. Surveyors should observe members of the RCW clan for signs of courtship and nesting behavior. The Service considers all cavities in a cluster to be active if RCW are observed in the cluster, even if only one cavity is observed to be in use by the RCW. A two-week breeding season continuous survey event is necessary to document cluster activity/inactivity. The number of birds comprising a given group can be determined by posting observers at cavity trees during morning departure times and evening return times. Several observers would normally be needed to ensure that all occupied trees in a given cluster are observed.

Foraging Area Surveys

Surveys for foraging area boundary determinations require both nesting season surveys and non-nesting season (fall) surveys (October 15 through December 15). As with the cluster activity survey, foraging area surveys require a two-week continuous survey

event to document foraging area boundaries. Two protocols are provided depending on the circumstances.

The first foraging survey protocol applies for projects that have active RCW cavities on the property. In this circumstance, foraging boundary surveys commence with observations of the RCW when they leave their roosts. The surveyor documents the number of birds and tracks the birds as they forage through the adjacent habitats. Data should be collected at ½ hour intervals, recorded on aerials, and/or documented with GPS coordinates for later mapping. If the RCW moves to a new location while being observed, the flight direction and the location where the RCW lands should be noted. Behavior and vocalizations should be noted, especially behavior that would indicate courtship or nesting.

The second foraging survey protocol applies to projects that do not have active RCW cavities on the property. In these circumstances, meandering walking transects are conducted through all suitable RCW habitat. The observer should stop every three to five minutes, look, and listen for RCW activity. Since RCW are territorial and will defend their territory from intrusion by other RCW, the use of vocal recordings of RCW will facilitate observations. Therefore, at each of the stops, provide a 30-second continuous play of RCW vocal calls. Tapes of RCW vocalizations are available from Audubon and Peterson field guide series.

Reports

A. Field data sheets that include:

1. Dates and starting and ending times of all surveys conducted;
2. Weather conditions during all surveys, including average temperature, wind speed and direction, visibility, and precipitation; and
3. Total number of RCW found and number of RCW territories.

B. Aerial photographs or vegetation maps:

1. The entire area of interest;
2. RCW locations, territory boundaries, and habitat descriptions; and

C. Locations of all RCW cavity and start trees and all RCW seen or heard while conducting the survey or at any other time, including flight direction.

E. Wood Stork

The endangered wood stork (*Mycteria americana*) inhabits marshes, cypress swamps, and mangrove swamps. Breeding colonies of this large wading bird currently exist in St. Lucie County and have occurred in Martin County. Typical foraging sites include freshwater marshes and stock ponds, shallow, seasonally flooded roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs (Service 1999).

In evaluating project effects to wood storks in Florida, the Service considers effects to the colony, the primary zone, the secondary zone, and the core foraging area (CFA) as direct effects and effects to foraging areas outside the CFA as indirect effects.

The Service considers the colony boundary to include all nests and a 100 meter (325 feet) buffer surrounding the nests. The primary zone adds an additional 400 meters to the colony boundary and the secondary zone adds an additional 350 meters to the primary zone boundary. The CFA is a 30-kilometer (18.6 mile) zone surrounding the colony boundary. The guidelines recommend restrictions in each of the zones that correspond to nesting and non-nesting season cycles. A nesting season cycle averages 115 to 120 days. Nest sites are generally in woody vegetation over standing water, or on islands surrounded by broad expanses of open water. In south Florida, the nesting season is generally from November through May. For central and north Florida, the nesting season is generally from February through August.

The location of the nearest wood stork colony will need to be determined. The location of the colony influences the evaluation of the project's effects to the colony, the primary zone, secondary zone, and the CFA. Because wood storks are a wetland dependent species, the habitat map needs to also show the wetlands on the property. Wetlands need to be classified as to type and hydroperiod.

Information on the presence of a wood stork colony can be found from a variety of sources. Colony location databases are maintained by the Service, the South Florida Water Management District (SFWMD), the Florida Fish and Wildlife Conservation Commission (FWC), the Florida Natural Areas Inventory, and county and local natural resource agencies. The SFWMD web site is <http://www.sfwmd.gov/org/erd/coastal/wading/index.html>. The FWC web site is <http://wld.fwc.state.fl.us/bba/default.asp>.

Storks require between 110 and 150 days for the annual nesting cycle, from the period of courtship until the nestlings become independent. Nesting activity may begin as early as December or as late as March in southern Florida colonies, and between late February and April in colonies located between central Florida. Thus, full term colonies may be active until June-July in south Florida, and as late as July-August at more northern sites. Colony sites may also be used for roosting by storks during other times of the year.

Almost all recent nesting colonies in the southeastern U.S. have been located either in woody vegetation over standing water, or on islands surrounded by broad expanses of open water. The most dominant vegetation in swamp colonies has been cypress, although storks also nest in swamp hardwoods and willows. Nests are usually located 15-75 feet above ground, but may be much lower, especially on island sites when vegetation is low.

Nesting storks show some variation in the levels of human activity they will tolerate near a colony. In general, nesting storks are more tolerant of low levels of human activity

near a colony when nests are high in trees than when they are low, and when nests contain partially or completely feathered young than during the period between nest construction and the early nestling period (adults still brooding). When adult storks are forced to leave their nests, eggs or downy young may die quickly (<20 minutes) when exposed to direct sun or rain.

Colonies located in flooded environments must remain flooded if they are to be successful. Often water is between 3 and 5 feet deep in successful colonies during the nesting season. Storks rarely form colonies, even in traditional nesting sites, when they are dry, and may abandon nests if sites become dry during the nesting period.

Roosting habitat

Although wood storks tend to roost at sites that are similar to those used for nesting, they also use a wider range of site types for roosting than for nesting. Non-breeding storks, for example, may frequently change roosting sites in response to changing feeding locations, and in the process, are inclined to accept a broad range of relatively temporary roosting sites. Included in the list of frequently used roosting locations are cypress "heads" or swamps (not necessarily flooded if trees are tall), expansive willow thickets or small, isolated willow islands in broad marshes, and on the ground either on levees or in open marshes.

F. Florida Scrub Jay

The threatened Florida scrub-jay (*Aphelocoma coerulescens*) is present in oak scrub throughout the Atlantic Coastal Ridge and the Savannas State Preserve. It is also present in the project area in eastern Okeechobee County and possibly along the Holopaw-Indiantown Ridge that continues into western St. Lucie County. We are uncertain whether scrub-jays occupy scrub habitat in the Trail Ridge North, Trail Ridge, and V_2 Ranch in St. Lucie County. Scrub-jays are extremely habitat-specific, sedentary, and territorial. Habitat loss is the main threat to the species, and a breeding pair requires a minimum of 5 hectares.

The most effective method for surveying a site for Florida scrub-jays is to traverse the area systematically, using a high quality tape recording of Florida scrub-jay territorial scolding in an attempt to attract the scrub-jays. The recording should include clear examples of all typical territorial scolds, including the female "hiccup" call. Determine the boundaries of the project and a 600 foot buffer surrounding the property. The reason for the 600-foot radius is that the FWC Scrub-jay Habitat Guide identifies a typical scrub-jay territory as an area of approximately 25 acres. To identify off-site territories that may overlap onto the property, the Service determined the center point of a 25-acre circular territory as the furthest point that would allow for overlap of an off-site territory onto the property. Map plant communities either on a 7.5-foot U.S. Geological Survey (USGS) topographic map or an aerial photograph at a scale of no more than 400 feet per inch. The vegetation map must show all forms of existing development. On the vegetation map, establish parallel line transects with playback stations along each

transect. Space the transects and playback stations so that all different scrub types will be sampled for scrub-jays (*i.e.*, so that the taped calls will be effectively broadcast across areas of concern). These scrub types should include not only the more "classic" xeric oak scrub, scrubby pine flatwoods, scrubby coastal strand, and sand pine scrub, but should also include: • improved, unimproved, and woodland pastures; citrus groves; rangeland; pine flat woods; longleaf pine xeric oak; sand pine; sand pine plantations; forest regeneration areas; sand other than beaches; disturbed rural land in transition without positive indicators of intended activity; and disturbed burned areas.

- The presence of scrub oaks, no matter how sparsely distributed, is the key indicator of "scrub" habitat. Distances between transects, and between stations along transects, depend on many factors, including power of the speaker used for broadcasting the calls, topography of the site, and the density of the surrounding vegetation. Adequate spacing between transects can be estimated roughly as the distance at which a person listening to the tape directly in front of the speaker perceives the "bird" to be no more than about 100 meters away. A distance of 100 to 200 meters between transects and between stations is generally adequate when using a good-quality, handheld cassette player broadcasting at full volume. Use 100 meters for dense canopy scrub and 200 meters for open scrub.

Surveys should be carried out on calm, clear days about one hour after sunrise, and should terminate before midday heat or wind. Surveys should not be conducted in winds stronger than a moderate breeze (5-8 mph), in mist or fog, or in precipitation exceeding a light, intermittent drizzle. Heat and especially wind lowers the tendency for scrub-jays to respond to distant territorial scolds, and wind reduces the distance over which recordings can be heard. Scrub-jays are also reluctant to fly on windy days regardless of hour or season. Surveys should be conducted during (1) spring (especially March), (2) fall (September and October), when territorial displays are most frequent and vigorous, and (3) midsummer (July) when young of the year are independent but still distinguishable by plumage. The poorest times of the year to survey are late winter, when scrub-jays are most likely to fly far for food, and late spring when the young are quiet and the adults are occupied with molt and feeding fledglings. Generally, a consecutive survey for a minimum of five days is sufficient to assess scrub-jay presence and territory size and distribution.

Transects may be driven or walked. If driven, step out or stand atop the vehicle at each playback station. Broadcast the calls at each station for at least one minute in all four directions around the playback station, emphasizing any direction in which low-growing oak scrub is the predominant vegetation. On the vegetation map, plot the locations and indicate group size of all Florida scrub-jays where they are first seen or heard. Note the direction from which they came. Distinguish adult-plumaged scrub-jays from juvenile-plumaged scrub-jays whenever possible. At localities with car trails, large areas of scrub can be surveyed with a vehicle in 1 day. On foot, the process is more laborious because of the relatively large size of territories (often 10 to 40 acres). Once a group is located, stop broadcasting at that station. Remaining at this station briefly should result in the assembly of the entire group. This allows one to estimate group size and, if done during the midsummer, to distinguish young of the year from adults. Sometimes two or

more groups will be attracted to one station, usually from different directions. Observers should be careful, therefore, to plot each group where it was first spotted or heard. In rare circumstances, especially at sites where numerous groups congregate at artificial food or water sources, it may be difficult to differentiate groups. This is especially true where scrub-jays have become habituated and tame to human approach. Again, in such cases careful observation is extremely important. Studies of such congregations using color-marked scrub-jays have confirmed that almost always they consist of members of different family groups. Often they may have crossed several territory boundaries to reach the neutral feeding or drinking areas. The result gives a false impression of extremely high scrub-jay density. It is essential that the subject area be surveyed to establish an accurate count of scrub-jay groups and territorial boundaries. If more than 8 to 10 scrub-jays are encountered at a single playback station during a fall or spring survey period, the scrub-jays at this site should be monitored carefully over several visits and different times of day. Numbers will shift as groups arrive and depart. Often it is possible to watch where the scrub-jays come from or return to as a means of determining how many groups are represented.

G. Snail Kite

The endangered snail kite (*Rostrhamus sociabilis plumbeus*), a medium-sized raptor, is a food specialist that feeds almost entirely on apple snails (*Pomacea paludosa*). These snails are found in palustrine emergent, long hydroperiod wetlands. Although the snail kite could be found foraging in a number of native wetlands and in canals and ditches throughout the IRL-S study area, some wetland complexes within and adjacent to the study area are known to be of particular importance to the species. Wetlands in the Savannas State Preserve and the Strazzulla property (the latter being part of the species' designated critical habitat) are known to be of particular significance for breeding and/or drought refuge (Service 1999). Survey protocols have not yet been finalized by the Service for this species. Land managers are urged to contact the Service when surveys for this species are needed.

H. Florida Panther

"The Florida panther [*Felis* (= *Puma*) *concolor coryi*] is one of the most endangered large mammals in the world. They prefer native, upland forests, especially hardwood hammocks and pine flatwoods, over wetlands and disturbed habitats" (Service 1999). At this time, panthers are not confirmed as occupying the study area. The core population is southwest of Lake Okeechobee. However, if this population increases in the future, it is possible that the panther's range may spread north of Lake Okeechobee and into the forested areas of western St. Lucie and Martin counties. Survey protocols have not yet been finalized by the Service for this species. Land managers are urged to contact the Service when surveys for this species are needed.

I. Eastern Indigo Snake

The threatened eastern indigo snake (*Drymarchon corais couperi*) is present throughout the state, but its abundance is reduced to a point where it is uncommon. Habitat includes pine flatwoods, scrubby flatwoods, high pine, dry prairie, tropical hardwood hammock, edges of freshwater marshes, agricultural fields, coastal dunes, and human-altered habitats. Eastern indigo snakes could be encountered during construction; therefore implementation of the standard construction practices to avoid adverse effect on the species is expected. Survey protocols have not yet been finalized by the Service for this species. Land managers are urged to contact the Service when surveys for this species are needed.

J. Whooping Crane

Experimental populations of the endangered whooping crane (*Grus americana*) have been released from the Three Lakes Wildlife Management Area east of Lake Kissimmee. Currently, this non-migratory population of 94 birds is widely scattered throughout the central portion of the state. One radio-tagged individual has been detected in St. Lucie County. Only four chicks have hatched and just one of the offspring has survived past 3 months. Whooping cranes occupy habitats similar to that of sandhill cranes (*Grus canadensis pratensis*; i.e., large fresh water marshes, pastures, wet and dry prairies, and open woods). There is a good potential for them to occupy the study area in the future assuming the population increases and the habitat is still present. Survey protocols have not yet been finalized by the Service for this species. Land managers are urged to contact the Service when surveys for this species are needed.

K. Scrub Plants

There are four endangered upland plant species that have been found in scrub habitat in the eastern portion of the study area on the Atlantic Coastal Ridge (Coile 2000). They may also be present in isolated scrub pockets not yet surveyed for plants. They are not likely to be affected by construction or operation and maintenance of reservoirs or STAs, however, when site visits are conducted for individual project components, any scrub habitat encountered should be surveyed for the following four plants.

Tiny polygala (*Polygala smallii*; endangered) is a milkwort found in sand pockets in pine rocklands, open sand pine scrub, slash pine, high pine, sandhills, and well-drained coastal spoil.

Four-petal pawpaw (*Asimina tetramera*; endangered) is found in coastal sand pine and scrub oak.

Fragrant prickly-apple [*Harrisia eriophora* (= *Cereus eriophorus* var. *fragrans*); endangered] is a tree cactus found in sand pine scrub, scrubby flatwoods, and coastal hammock. Florida perforate cladonia (*Cladonia perforata*; endangered), commonly called reindeer lichen, is found in high, well-drained sands of rosemary scrub.

Surveys for listed plants must be conducted during the appropriate season in order to identify plants to species. A number of searches in the same area are frequently necessary to detect plants by flower, fruits, leaf structures, or growth patterns. Tiny polygala flowers year-round. Fragrant prickly-apple and Florida perforate cladonia can also be surveyed year-round, but need to be identified by vegetative structures instead of flowers or fruits. Four-petal pawpaw flowers from April through July.

The surveyor should meander randomly through the project area and specifically in areas to be developed, until they are well convinced that either the suspect plants do not occur there or the suspect plants have been adequately mapped. The meander should bisect most of the portions of the survey unit, pass through and intensively search all suspect habitats, pass through all differing plant associations in the unit, and pass through any significant changes in aspect, slope, substrate, etc.

The meander method gives the surveyor the greatest latitude in selecting a route through a unit that would most likely reveal the suspect plant species (as opposed to a systematic grid). It places all responsibility of knowing the habitat attributes of the suspect plant on the surveyor. It requires that the surveyor review habitat attributes of the project area or survey unit carefully in maps, aerial photos, and on the ground.

The survey is complete when most portions of the project area have been bisected by the meander, all unique habitats have been intensively searched, and the number of herbaceous plants encountered per unit area remain constant, i.e., the surveyor stops seeing new plant species as they walk through representative portions of the survey area.

Each surveyor shall calibrate their walking stride into the number of paces which equals 100 feet. As the surveyor paces out 100 feet they record the plant species by 100-foot section number. Use species codes, genus name, the species name, or common name. Unknown plants must be keyed out in the field to a point where it is assured that unknown plants are not listed plants. Most plant codes are formed by taking the first two letters of the genus name and specific epithet, or first one or two letters or common name(s), to total four letters.

2. State Listed Threatened and Endangered Species Surveys

Certain state listed species are either known to, or are expected to, occupy the IRL-S Project Area. These are listed in Table 1 and Table 2. The SFWMD will need to consult with the FWC and the Florida Department of Agriculture and Consumer Services to determine potential impacts to these species and the need for remediation activities (e.g., construction precautions or relocation requirements).

The primary state listed species that would need baseline (*i.e.*, pre-construction) inventories, and that may be good candidates for additional surveys include the gopher tortoise, Florida sandhill crane, burrowing owl, Sherman's fox squirrel, and the following wading birds: limpkin, little blue heron, reddish egret, roseate spoonbill, snowy egret,

tricolored heron, and white ibis. The FWC has protocols for these species that generally require the site to be surveyed for a minimum of 5 days in the appropriate habitat (see Allen 1988). Pedestrian or aerial surveys are recommended, where applicable. Traps for small mammals and herps are recommended. Additional survey methods are recommended for gopher tortoises and their commensal species (gopher frog, indigo snake, and pine snake).

At this time, it is unknown if any of the plants listed in Table 2 are more likely to occupy the site. We recommend that the Florida Department of Agriculture and Consumer Services be consulted with to determine plant recovery priorities and survey methods.

3. Baseline Surveys for General Fish and Wildlife

Baseline surveys would commence as soon as land is acquired and money is available, and must precede construction activities. The purpose of the baseline monitoring is to determine the number of species present and relative abundance. This information will provide a baseline for biodiversity analyses across areas and over time. Knowing the diversity and relative abundance of floral and faunal species present on-site will guide future monitoring and adaptive management needs. Existing data, if available, such as Conservation and Recreation Lands or Save Our Rivers surveys should be reviewed, evaluated, and should guide baseline monitoring.

Tasks in Section IV (4.A.2, 5.A, and 6.A) call for the one-time inventory of birds, fish, reptiles, amphibians, and small mammals. Survey costs are based on 1 day per 2000 acres for a team of 4 people for all species combined. Protocols should be generally followed as set forth in Allen (1988).

Table 1. Species listed by the Florida Freshwater Fish and Wildlife Conservation Commission as endangered (E), threatened (T) or of special concern (SSC), excluding those that are also federally listed, that are or may be present on the Allapattah Ranch Natural Area.

<u>Common Name</u>	<u>Species Name</u>	<u>Status</u>
REPTILES		
American alligator	<i>Alligator mississippiensis</i>	SSC
Florida pine snake	<i>Pitophis melanoleucas mugitus</i>	SSC
Gopher tortoise	<i>Gopherus polyphemus</i>	SSC
AMPHIBIANS		
Gopher frog	<i>Rana capito</i>	SSC
BIRDS		
American oystercatcher	<i>Haematopus palliatus</i>	SSC
Black skimmer	<i>Rynchops niger</i>	SSC
Brown pelican	<i>Pelecanus occidentalis</i>	SSC
Burrowing owl	<i>Speotyto cunicularia</i>	SSC
Florida sandhill crane	<i>Grus canadensis pratensis</i>	T
Least tern	<i>Sterna antillarum</i>	T
Limpkin	<i>Aramus guarauna</i>	SSC
Little blue heron	<i>Egretta caerulea</i>	SSC
Peregrine falcon	<i>Falco peregrinus</i>	E
Reddish egret	<i>Egretta rufescens</i>	SSC
Roseate spoonbill	<i>Ajaia ajaja</i>	SSC
Snowy egret	<i>Egretta thula</i>	SSC
Southeastern American kestrel	<i>Falco sparverius paulus</i>	T
Tricolored heron	<i>Egretta tricolor</i>	SSC
White ibis	<i>Eudocimus albus</i>	SSC
MAMMALS		
Florida mouse	<i>Podomys floridanus</i>	SSC
Sherman's fox squirrel	<i>Sciurus niger shermani</i>	SSC

Table 2. Species listed by the Florida Department of Agriculture and Consumer Services as threatened (T), endangered (E), or commercially exploited (C), excluding those that are also federally listed.

Common Name	Species Name	Status
PLANTS		
Blackbeard	<i>Pithecellobium keyense</i>	T
Blue flowered butterwort	<i>Pinguicula caerulea</i>	T
Blunt-leaved peperomia	<i>Peperomia obtusifolia</i>	E
Catesby's lily	<i>Lilium catesbaei</i>	T
Curtiss' (=sandhill) milkweed	<i>Asclepias curtissii</i>	E
Dentate lattice vein fern	<i>Thelypteris serrata</i>	E
Dingy-flowered epidendrum	<i>Epidendrum anceps</i>	E
Fall-flowering pleat-leaf; celestial lily	<i>Nemastylis floridana</i>	E
False buttonweed	<i>Spermacoce</i> (=Bouerreria) <i>terminalis</i>	T
Florida coontie	<i>Zamia floridana</i>	C
Florida jointtail grass	<i>Coelorachis tuberculosa</i>	T
Giant sword fern	<i>Nephrolepis biserrata</i>	T
Hand adder's tongue fern	<i>Ophioglossum palmatum</i>	E
Inflated (=reflexed) wild pine	<i>Tillandsia balbisiana</i>	T
Lace-lip ladies' tresses	<i>Spiranthes laciniata</i>	T
Leafless beak orchid	<i>Stenorrhynchos lanceolatus</i>	T
Many-flowered grass pink	<i>Calopogon multiflorus</i>	E
Night-scent orchid	<i>Epidendrum nocturnum</i>	E
Pale-flowered polystachya	<i>Polystachya concreta</i> (=P. <i>flavescens</i> ; =P. <i>extinctoria</i>)	E
Peperomia (unnamed)	<i>Peperomia humilis</i>	E
Pine (=spreading) pinweed	<i>Lechea divaricata</i>	E
Plume polypoda fern	<i>Polypodium</i> (=Peccluma) <i>plumula</i>	E
Polypoda fern (unnamed)	<i>Polypodium</i> (=Peccluma) <i>dispersum</i>	E
Satinleaf	<i>Chrysophyllum oliviforme</i>	T
Simpson's ironwood; Simpson's stopper	<i>Myrcianthes fragrans</i> (=Eugenia <i>simpsonii</i>)	T
Simpson's zephyr lily	<i>Zephyranthes simpsonii</i>	T
Soft-leaved wild pine	<i>Tillandsia valenzuelana</i>	T
Swamp plume polypoda fern	<i>Polypodium</i> (=Peccluma) <i>ptilodon</i>	E
Twisted and banded air plant	<i>Tillandsia flexuosa</i>	E
Unscented vanilla	<i>Vanilla mexicana</i>	E
Yellow flowered butterwort	<i>Pinguicula lutea</i>	T

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Field Monitoring Forms for Caracara and Bald Eagle

Crested Caracara Monitoring Field Data Form

Date: _____ Start Time _____ Stop Time _____ Monitor _____

Site Name and Location: Include latitude and longitude, section, township, and range, and County. _____

Weather Data

Time	Temp	Wind Speed/Direction	% Cloud Cover	Cloud Type	Rain
Start					
Finish					

Flight Data

#	Age A/Im	Time	Description

Nesting Data: Observed Activity

(perching, preening, courtship, feeding, nest building, incubation, head color change, head throwback, diving)

#	Age A/Im	Time	Description

General Observations

(crested caracara reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

#	Age A/Im	Time	Description

Bald Eagle Monitoring Field Data Form

Date: _____ Start Time _____ Stop Time _____ Monitor _____

Weather Data

Time	Temp	Wind Speed	% Cloud Cover	Cloud Type	Rain

Flight Data

Time	Description

Nesting Data: Observed Activity

(perching, preening, courtship, feeding, nest building, copulation, incubation, alarm calls, head bobbing, diving)

Time	Description

General Observations

(eagles reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

Time	Description

Water Quality, Fish, and Sediment Sampling Scheme for the Allapattah Ranch Natural Area.

Day 1. Tasks to be completed.

- II.1.B.1. Fish Tissue (Mercury and Organochlorine pesticides; 100 mosquito fish)
- II.1.B.2. Fish Tissue (Mercury and Organochlorine pesticides; 5 sunfish)
- IV.5.B. Anecdotal fish sampling

Day 2. Tasks to be completed.

- II.1.A. On-site water quality grab sample
- II.2.A. Water quality leaving site (composite sample)
- II.2.B. Water quality leaving site (grab sample)
- II.2.D. Groundwater sampling (if necessary)

Day 3. Tasks to be completed.

- II.1.C. Sediment Composite Monitoring (Mercury, if necessary)

Cost breakdown

Staff time = 1 person = \$800 per day,
2 persons = \$1600 per day,
3 persons = \$2000 per day, and
4 persons = \$2400 per day.

Car rental = \$68/day (source: AAT MAP)

Equipment = \$17/day for field chemistry kits (source: AAT MAP)
\$10/day for fixatives, ice, coolers
\$30/site for sample bottles (source: AAT MAP)
\$5/site for hexane and aluminum foil (for fish tissue sampling)
\$20/site for glass bottles (for sediment samples)
\$60/day for electrofishing equipment
\$20/day for sample compositor (2 needed)

Lab analysis costs per task

- II.1.A. On-site water quality grab sample = \$80/sample
- II.2.A. Water quality leaving site composite sample = \$80/sample
- II.2.B. Water quality leaving site grab sample = \$80/sample
- II.2.D. Groundwater sampling (if necessary) = \$55/sample
- II.1.B.1. Mercury monitoring (100 mosquitofish composite) = \$135/sample
- II.1.B.2. Mercury monitoring (5 whole sunfish composite) = \$135/sample
- IV.5.B. Anecdotal fish sampling = none
- II.1.C. Mercury monitoring (sediment composites, if necessary) = \$511/sample

Total Costs per Day

Day 1. 3 field staff

	$\$2000 + \$68 + \$60 = \2128
II.1.B.1. Mercury monitoring (100 mosquito fish)	$\$10 + \$5 + (\$555 \times 4) = \2235
II.1.B.2. Mercury monitoring (5 sunfish)	$\$5 + (\$555 \times 4) = \$2225$
IV.5.B. Anecdotal fish sampling	cost incl. with tasks above

SUBTOTAL COST PER SAMPLING EVENT = \$6588

Number of sampling events per year = 1

Total cost per year = \$6,588

Day 2. 2 field staff

	$\$1600 + \$68 + \$17 + \$10 = \$1695$
II.1.A. On-site water quality grab sample	$(\$30 \times 3) + (\$80 \times 3) = \$330$
II.2.A. Water quality leaving site (composite sample)	$(\$30 \times 2) + (\$20 \times 2) + (\$80 \times 2) = \260
II.2.B. Water quality leaving site (grab sample)	$(\$30 \times 2) + (\$80 \times 2) = \$220$
II.2.D Groundwater sampling (if necessary)	$(\$30 \times 2) + (\$55 \times 2) = \$170$

SUBTOTAL COST PER SAMPLING EVENT = \$2675

Number of sampling events per year = 24

Total cost per year = \$64,200

Day 3. 2 field staff

	$\$1600 + \$68 + \$10 = \1678
II.1.B.3. Mercury monitoring (sediment composites, if necessary)	$(\$20 \times 12^*) + (\$511 \times 12^*) = \$6372$

SUBTOTAL COST PER SAMPLING EVENT = \$8050

Number of sampling events per year = 1

Total cost per year = \$8,050

* The actual number of sites needed to sample will be based on fish tissue results; therefore, the maximum number would be 4 sites each represented by 3 samples in any given year if all fish samples had concentrations greater than applicable standards.

ANNUAL TOTAL COSTS FOR WATER QUALITY, FISH, AND SEDIMENT ANALYSES = \$78,838

INDIAN RIVER LAGOON – SOUTH PROJECT ECOLOGICAL MONITORING PLAN FOR THE ST. LUCIE ESTUARY AND THE INDIAN RIVER LAGOON

Water Quality Monitoring

For the St. Lucie Estuary and the Indian River Lagoon region, the existing fixed station water quality monitoring network (Figure 1) administered by the SFWMD will be used to measure both the nutrient loads from major canals and tributaries into the estuary and lagoon, as well as the water quality within the tributaries, lagoon and estuary. There are currently thirteen (13) stations being monitored at inflows to and open water sites in the St. Lucie Estuary, along with twenty-one (21) open-water stations in the IRL (two of which are near the Loxahatchee River Estuary) for physical parameters, nutrients and chlorophyll using grab samples. The St. Lucie Estuary sites are sampled monthly, while the IRL sites are sampled 7 out of 12 months a year (weighted toward wet season months). It is recommended that site SLE08, which currently sits on a sand bar, be moved slightly northwestward into deeper water of the south fork of the St. Lucie Estuary. Five (5) inflow structures to the St. Lucie Estuary are currently monitored with flow proportional automatic samplers. Three additional sites, including a non-tidally influenced site (NEW 1) at an inflow point from the South Fork area, will be equipped with equivalent instrumentation (i.e., continuous flow recorders and automatic samplers), if feasible, to obtain more accurate load estimates. Much of the entire surface water monitoring network for this system has been recently optimized (spatially, temporally, and selection of parameters) to monitor the future effects of CERP and will require little modification.

To capture the effects of seasonal variation and minimize serial correlation, a monthly sampling frequency will be used for most surface water quality parameters. Physical parameters such as dissolved oxygen, conductivity, pH, salinity, and temperature will be collected directly in the field using water quality monitoring probes. Measuring photosynthetically active radiation (PAR), which is the method currently being used to measure water clarity in many areas, is preferred over Secchi disk depth measurements. Both PAR and Secchi disk depth measurements are to be used; however, Secchi measurements would only be performed where 1) Secchi disk depths have historically been used to measure light penetration, or 2) equipment to measure PAR cannot be obtained. Secchi disk depth and PAR measurements within strategic areas of estuaries will monitor improvements due to reduction in suspended solids released to tide and reestablishment of hydroperiods that more naturally mimic the historic, natural conditions.

Sampling for the majority of the other parameters will be conducted on a monthly or quarterly basis using grab samples and subsequent laboratory analysis. However, estimation of nutrient loading to estuaries requires the monitoring of water discharge (flow) and nutrient concentrations. Because water discharge is highly variable, continuous monitoring with flow meters and automatic samplers will be conducted at the

outflow points of canals, rivers and creeks. Continuous flow monitoring at all major tributary structures where water enters the estuary will be conducted where feasible; measure of inflows to the estuary can also be estimated by stage (head water/tail water). **Such continuous monitoring equipment has already been deployed at some inflow points.** Nutrient loading estimates could be based on occasional (e.g. monthly) grab samples, but such sampling is likely to miss pulses of nutrients associated with high flow events. Accurate estimates thus require automatic sampling. Less frequent grab sampling is still required for inorganic nutrients because these nutrient species cannot be preserved in the field over periods of weeks. Based on past studies of inflow points in estuaries, composite sampling on a weekly basis is adequate to capture nutrient pulses and tidal variations and minimize analytical costs.

Sediment sampling for pollutants will be conducted at the 13 St. Lucie Estuary monitoring stations to measure influx of toxicants into the estuarine system. Sediment samples will be collected bi-annually and analyzed for trace metals, pesticides, polynuclear aromatic hydrocarbons (PAHs), and polychlorinated bi-phenols (PCBs). Surface water and sediment sampling methodologies used to collect parameter information, as well as hydrologic measurements, associated Quality Control requirements, and methods used for subsequent laboratory analyses are described in the **CERP Quality Assurance Systems Manual (in prep.)**.

Sampling parameters, monitoring sites, sampling frequency and collection methods are shown in Tables 1 and 2.

Estimated Cost for Water Quality Monitoring

Purchase and install 3 continuous sampling stations (one-time cost)	\$21,000
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Annual monitoring costs:

Sample analysis	\$111,086
Field work	\$144,605
Report preparation	\$38,768
Travel costs	\$13,200
Labor costs	\$88,477

First year monitoring cost	\$417,136
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Total annual water quality monitoring cost after the first year	\$396,136
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Figure 1: St. Lucie Estuary and Indian River Lagoon Water Quality Monitoring Stations

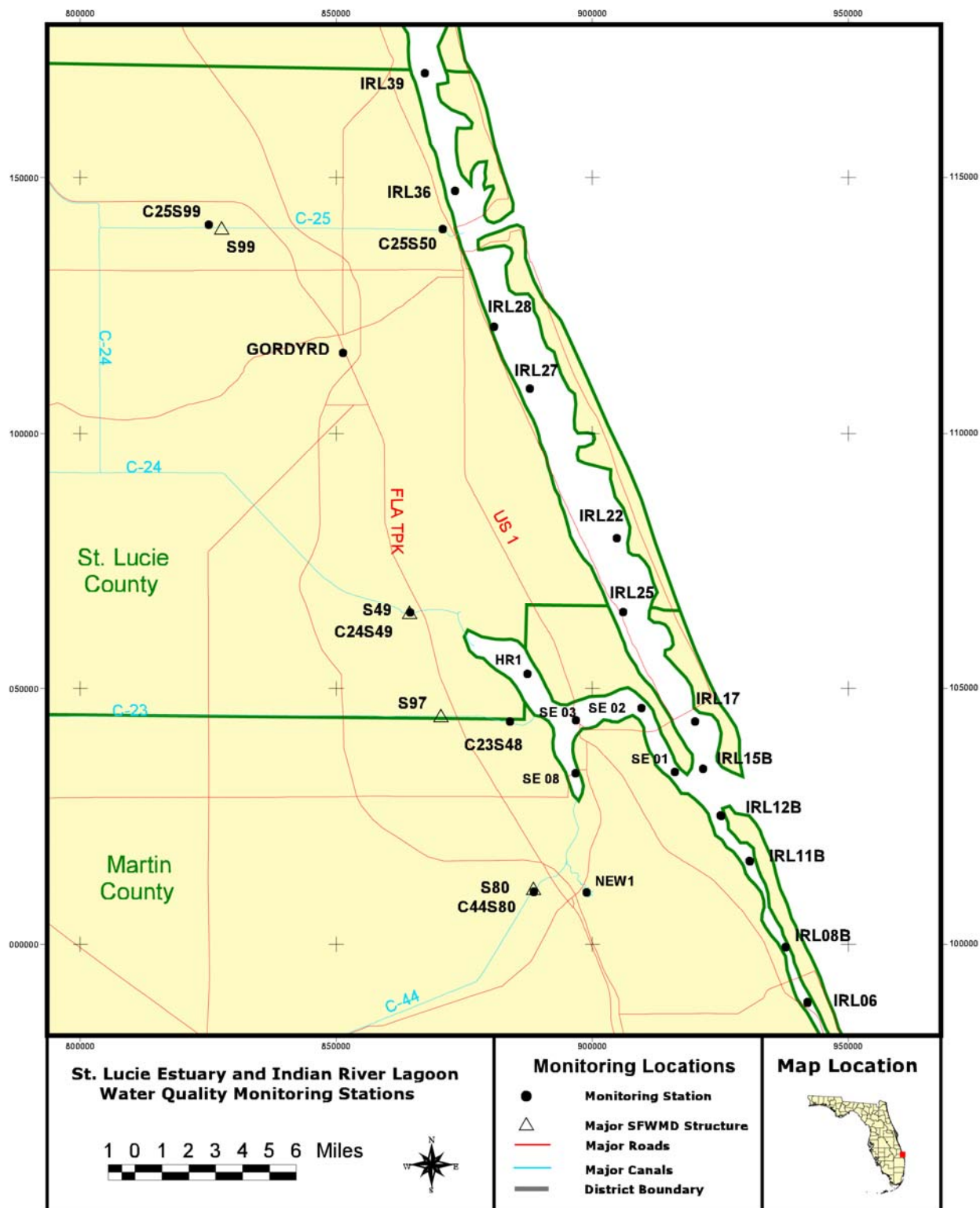


Table 1: Recommended Water Quality Monitoring (Nutrient Loads and Canal/River Quality)

Medium	Group	Parameters	Sites	Frequency	Collection Method
Water	Physical Parameters	DO, Cond, pH, Temp, Alkalinity, Turb, TSS, Color(DOC?)	SLE –C25S99, C25S50, GORDYRD, C24S49, C23S48, C44S80, NEW 1	Monthly	Water Quality Probe and Grab
Water	Nutrients	TP, OPO ₄ , TKN, NO ₂ , NH ₃ , NO ₂₊₃ , SiO ₂	See Above	Weekly and Monthly	Flow Proportional Autosampler and Grab (Upstream and Downstream)
Water	Other Core Parameters	SO ₄ , Cl, Ca, Mg, NA, K	See Above	Monthly/Quarterly	Grab
Water	Trace Metals	Trace Metals- As, Cr, Cu, Fe	See Above	Monthly/Quarterly	Grab
Sediment	Toxicants	Trace Metals – Complete Digestion (As, Ag, Al, Cd, Cr, Cu, Fe, Mn, Ni, Pb, and Zn); pesticides; PAHs and PCBs.	See Above	Bi-annually	Core
Water	Flow	Flow	See Above	Continuous	Flow Recorder

Table 2: Recommended Water Quality Monitoring (Estuarine)

Medium	Group	Parameters	Sites	Frequency	Collection Method
Water	Physical Parameters	DO, Cond, pH, Salinity, Temp, PAR/Secchi, Turbidity, TSS, VSS, Color (DOC)	<p>SLE01, SLE02, SLE03, SLE04, SLE06, SLE07, SLE08, SLE09, SLE10, SLE 11, SE12, SE 13, HR1</p> <p>IRL06, IRL08B, IRL11B, IRL12B, IRL15B, IRL7, IRL18B, IRL21, IRL22, IRL24, IRL25, IRL27, IRL28, IRL29, IRL31, IRL34B, IRL36, IRL39, IRL40</p>	<p>Monthly</p> <p>Jan, Feb, April, May, June, July, Aug, Oct</p>	Water Quality Probe and Grab
Water	Nutrients	TP, TKN, NO ₂ , OPO ₄ , NH ₃ , NO ₂₊₃	<p>SLE01, SLE02, SLE03, SLE04, SLE06, SLE07, SLE08, SLE09, SLE10, SLE 11, SE12, SE 13, HR1</p> <p>IRL06, IRL08B, IRL11B, IRL12B, IRL15B, IRL7, IRL18B, IRL21, IRL22, IRL24, IRL25, IRL27, IRL28, IRL29, IRL31, IRL34B, IRL36, IRL39, IRL40</p>	<p>Monthly</p> <p>Jan, Feb, April, May, June, July, Aug, Oct</p>	Grab

Medium	Group	Parameters	Sites	Frequency	Collection Method
Water	Biologic	Chlorophyll a, b, c, corrected-a, pheophytin and carotenoids	<p>SLE01, SLE02, SLE03, SLE04, SLE06, SLE07, SLE08, SLE09, SLE10, SLE 11, SE12, SE 13, HR1</p> <p>IRL06, IRL08B, IRL11B, IRL12B, IRL15B, IRL7, IRL18B, IRL21, IRL22, IRL24, IRL25, IRL27, IRL28, IRL29, IRL31, IRL34B, IRL36, IRL39, IRL40</p>	<p>Monthly</p> <p>Jan, Feb, April, May, June, July, Aug, Oct</p>	Grab
Water	Biologic	Phytoplankton Community Composition	<p>SLE01, SLE02, SLE03, SLE04, SLE06, SLE07, SLE08, SLE09, SLE10, SLE 11, SE12, SE 13, HR1</p> <p>IRL06, IRL08B, IRL11B, IRL12B, IRL15B, IRL7, IRL18B, IRL21, IRL22, IRL24, IRL25, IRL27, IRL28, IRL29, IRL31, IRL34B, IRL36, IRL39, IRL40</p>	Quarterly or Event Driven	Grab
Sediment	Toxicants	Trace Metals – Total Digestion: (As, Ag, Al, Cd, Cr, Cu, Fe, Mg, Mn, Ni, Pb, and Zn); Pesticides; PAHs and PCBs.	SLE01, SLE02, SLE03, SLE 4, SLE06, SLE07, SLE08, SLE09, SLE10, SLE 11, SE12, SE 13, HR1	Bi-annually	Core

Monitoring Mercury Concentration in Fish Tissue

Appropriate fish samples will be collected to evaluate potential mercury bioaccumulation pathways to humans (via analysis of edible fish filet) and wildlife (via analysis of whole fish), using the target species recommended in the CERP Monitoring and Assessment Plan. The recommended species include:

- Crevalle jack (*Caranx hippos*) – filet (12-15 inches)
- Gray snapper (*Lutjanus griseus*) – whole and filet (10-13 inches)

Sampling frequency and intensity: Twenty fish from each species will be collected annually from the St. Lucie River Estuary (SLE) and from the Indian River Lagoon (IRL). A maximum of seven fish shall be collected from any one sampling location.

Analysis: Fish tissue shall be analyzed for total mercury. For gray snapper, samples of both a small portion of the filet as well as the whole fish shall be analyzed until a relationship between the mercury concentrations in the filet and the whole body can be adequately developed (approximately 50-60 samples). After which, only the fillet would be analyzed.

Otoliths are to be reserved for determining the age of the fishes. If it is later determined that certain species are not to be aged, then fish of a given size range would be targeted.

Estimated Cost for Sampling and Analysis of Mercury in Fish Tissue

Biologist	= \$600 per day
Per diem	= \$100/day
Vehicle Rental	= \$70/day
Boat Rental	= \$250/day
Equipment	= \$10/day for fixatives, ice, coolers
Misc.	= \$ 30/sampling event for hexane and aluminum foil
Hg Analysis	= \$135/sample

Daily field costs:

Biologist: 2@ \$600/day	=	\$1600/day
Per diem: 2@ \$100/day	=	200/day
Vehicle Rental: \$70/day	=	70/day
Boat Rental: \$250/day	=	250/day
Coolers, ice: \$10/day	=	<u>10/day</u>
		\$1,730/day

(\$1,730/day x 6 days per sampling event) + \$30 (hexane & Al foil) = \$10,410 per sampling event

Hg analysis: 120 samples x \$135/sample = \$16,200 per sampling event

Total Cost for 1 sampling event per year: \$10,410 + \$16,200 = \$26,610

Report generation (7 days) = \$4,200

Total annual cost: \$30,810

Once whole gray snapper can be eliminated from sampling and analysis the number of sampling days per event can be reduced to 4 and the number of samples analyzed can be reduced to 80.

$(\$1,730/\text{day} \times 4 \text{ days per sampling event}) + \$30 \text{ (hexane)} = \$6,950 \text{ per sampling event}$
 $\text{Hg analysis: } 80 \text{ samples} \times \$135/\text{sample} = \$10,800 \text{ per sampling event}$
 $\text{Total Cost for 1 sampling event per year: } \$6,950 + \$10,800 = \$17,750$
 $\text{Report generation (7 days)} = \$4,200$

Total annual cost: \$21,950

Juvenile Fish Monitoring

1. SLE Juvenile fish sampling in SAV

Sampling will utilize a stratified design for areas of 15-24 ppt salinity where SAV is expected to re-establish itself. These are the same sites at which MAP will conduct SAV recruitment transects so that SAV recruitment and fish utilization can be correlated. The open-water seine methodology and gear used for sampling will be identical to that used by the FWC – FMRI Fisheries Independent Monitoring (FIM) Program. The MAP recommends both 70 and 600 ft seines to be performed at the same sites as the future SAV sampling (MAP Figure 3-48). One seine haul will be conducted at each randomly chosen site, with 5 seine hauls within the strata per sampling period. Sampling periods will occur monthly. All fish will be measured and identified to species. Field time for the sampling should take 2 days per sampling event. Analysis will consist of community level statistics.

Monitoring costs:

1 Biologist for trip prep (\$600/day) @ 1 day	\$600
3 Biologists (\$600/day) @ 2 days	\$3,600
Boat rental (\$250/day) @ 2days	\$500
Vehicle rental (\$70/day) @ 2 days	\$140
Per diem (\$100/day) 3 @ 2 days	\$600
Misc.	\$500
Total/trip	\$5,340
12 trips/year	\$64,080
Analysis (15 days)	\$9,000
Report generation (10 days)	\$6,000
Total annual monitoring cost	\$79,080

2. SLE Juvenile fish sampling in the reef ball artificial habitat

Reef balls should recruit recreationally important fish such as grey snapper and gag grouper. Due to the nature of the reef balls, the shallow depths of their deployment and the low visibility in the SLE, typical sampling methods will be difficult or impossible to employ in this area. Qualitative data will be collected annually by a visual census using a tethered video camera. This information should reveal what types of fish are utilizing the reef balls.

Monitoring costs:

1 Biologist (\$600/day) @ 1 day	\$600
1 Technician (\$300/day) @ 1 day	\$300
Boat (\$250/day) @ 1 day	\$250
Vehicle rental (\$70/day) @ 1 day	\$ 70
Total/trip	\$970
12 trips per year	\$11,640
Camera	\$1500
Analysis (5 days)	\$3,000
Report generation (7 days)	\$4,200
Total annual monitoring cost	\$20,340

Sedimentation Monitoring

SLE Sedimentation analysis:

Muck accumulation is a critical component of this project. Currently muck accumulation is occurring at approximately 3 times the historical rate. Sedimentation traps will be placed at 10 locations throughout the estuary associated with the muck removal sites. Each sedimentation trap will be measured monthly with the collected material sent through grain size analysis.

Monitoring costs:

Field data collector/diver (\$400/day) @ 1 day	\$400
Standby diver (\$400/day) @ 1 day/	\$400
Dive supervisor (\$450/day) @ 1 day	\$450
Tenders (2 x \$300/day) @ 1day	\$600
Boat operator (\$300/day)	\$300
Boat rental (\$250/day) @ 1 day	\$250
Vehicle rental (\$70/day) @ 1 day	\$ 70
Misc.	\$ 30

Total/trip	\$2,500
12 trips/year	\$30,000
11 sedimentation traps (\$500/trap)	\$5500
Grain size and organic content analysis:	
Grain size (\$50/sample) @ 10 samples	\$500
Organic content (\$25/sample) @ 10 samples	\$250
Sedimentation monitoring will be performed at the beginning of the project and once a year for 5 years after the reservoirs are completed.	
Analysis (15 days)	\$9,000
Report generation (10 days)	\$6,000
Total annual monitoring cost	\$51,250

Monitoring Submerged Aquatic Vegetation (SAV)

Mapping SAV utilizing Aerial Photography

The SFWMD regularly evaluates SAV in the southern Indian River Lagoon by mapping SAV distribution using aerial photography. SAV mapping of the Southern Indian River Lagoon has been conducted every two to three years since 1986 and includes downstream portions of the St. Lucie Estuary. The mapping data are used to identify SAV acreage trends and distribution changes. As recommended in the RECOVER MAP aerial photo surveys and mapping of SAV will continue at two-year intervals.

SAV Transects/Visual Surveys

SAV beds in the St. Lucie Estuary were mapped under contract to the SFWMD in 1997, although very little SAV was present in the estuary at that time. Subsequent spot checks conducted by SFWMD support this finding. SAV beds have been observed within the southern Indian River Lagoon. Transect monitoring of SAV within the southern Indian River Lagoon began in 1994, and is conducted twice a year (winter and summer), and includes 19 transects, two of which are just inside the mouth of the St. Lucie Estuary (Figure 2). Parameters monitored include species present, percent cover, canopy height, edge of bed location, species depth profiles, and shoot counts.

(See Virnstein and Morris 1996 for a detailed description of the monitoring methods.)

In addition to the SAV aerial mapping, the MAP recommends continuing the SAV transect monitoring within the Indian River Lagoon discussed above with the addition of six new permanent transects in the St. Lucie Estuary. Prior to CERP implementation, it is unlikely that significant areas of SAV will be present in the St. Lucie Estuary based on the 1997 survey and subsequent spot checks. Detailed transect monitoring therefore is not warranted until salinity and water clarity conditions improve sufficiently to allow SAV recruitment and growth. Prior to and during CERP implementation, general surveys for SAV should be conducted annually (spring/summer). These surveys will require divers to visually inspect the nearshore estuary bottom (areas less than 1 m deep) to look for SAV. Six general monitoring locations are suggested for these surveys: two sites each in the North Fork, South Fork, and mid estuary (Figure 2). Once SAV begins to recruit and grow in the estuary, the general surveys would be modified to provide a more detailed transect monitoring design. Actual transect locations would be determined in the field based on SAV distribution observed during the general surveys.

Monitoring Costs:

Mapping SAV utilizing aerial photography (once every 2 years) \$40,000

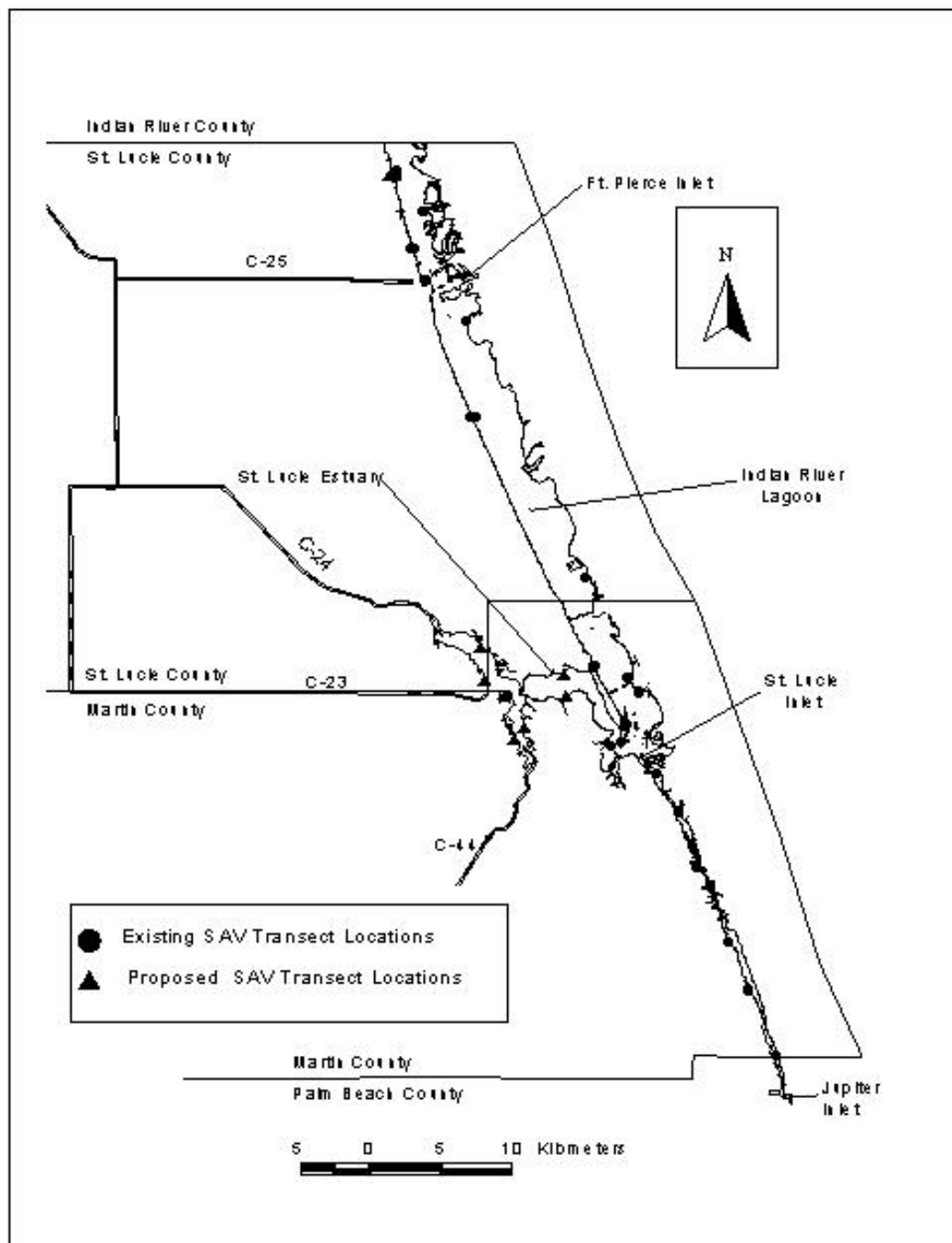
SAV transects and visual surveys

1 Biologist for trip prep. (\$600/day) @ 1 day	\$ 600
3 Biologist/divers (\$600/day x 3) @ 5days	\$9,000
1 Dive Supervisor (\$450/day) @ 5 days	\$2,250
1 Boat Operator (\$300/day) @ 5 days	\$1,500
Boat Rental (\$250/day) @ 5days	\$1,250
Vehicle Rental (\$70/day) @ 5 days	\$ 350
Per diem (\$100/day x 5) @ 5 days	\$2,500
Misc.	\$ 100
Total/trip	\$17,550

2 trips/year	\$35,100
Analysis (15 days @ \$600/day)	\$9,000
Report preparation (10 @ \$600/day)	\$6,000

Total annual monitoring cost for SAV transect surveys \$50,100

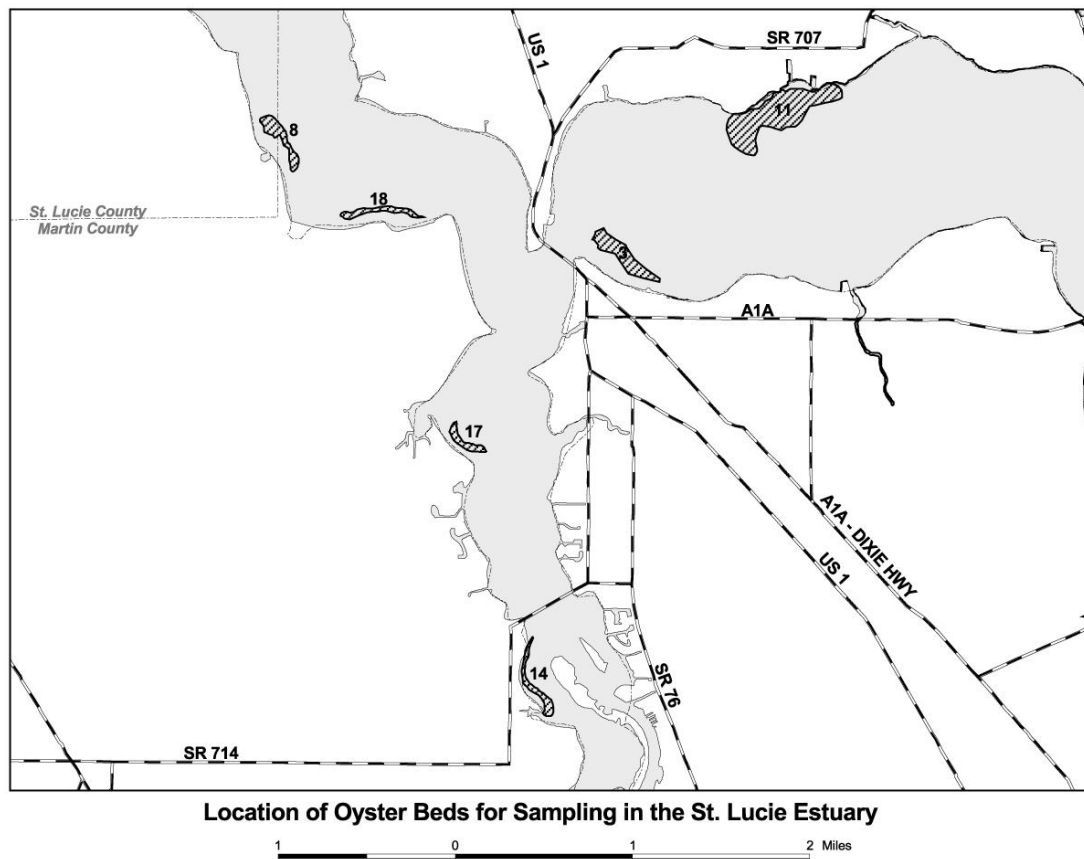
Figure 2: Existing and Proposed SAV Monitoring Locations within the St. Lucie Estuary and southern Indian River Lagoon



Oyster Monitoring

A detailed survey of the eastern oyster in the St. Lucie River was conducted under contract to the SFWMD in the late summer/early fall of 1997. The survey revealed that oyster shells are present throughout the estuary, but healthy oyster beds are scarce. Densities of the live oysters within the existing beds were typically very low (1 to 40%). Of the oyster beds mapped, six (Figure 3) were selected for studying oyster recruitment in the St. Lucie Estuary from April 2000 to October 2001. A spat monitoring location was also established in the Indian River to monitor recruitment in a higher salinity environment. Oysters monitoring under this plan will include both spat and adults to evaluate recruitment and survivorship success. Spat recruitment monitoring would be conducted at the seven stations already established by SFWMD (six sites on Figure 3 plus one Indian River Lagoon site). Recruitment monitoring would encompass a four-month period at the peak recruitment time (mid-March to mid-July) with spat collectors sampled every two weeks. Adult monitoring is recommended twice a year (winter and summer) at the six estuary sites (Figure 3) and would include measurements of size (live and dead) and percent alive.

Figure 3: Oyster Beds for Oyster Spat and Adult Monitoring within the St. Lucie Estuary



Estimated Cost for Monitoring Oyster Spat

Biologist = \$600/day
Technician = \$300/day
Per diem = \$100/day
Vehicle Rental = \$70/day
Boat Rental = 250/day
Equipment = \$10/day for fixatives, ice, cooler

Monitoring cost:

1 Biologist for trip prep (\$600/day) @ 0.5 day	\$300
2 Biologist (\$600/day each) @ 2 days	\$2,400
Per diem (\$100/day) 2 biologists @ 2 days	\$400
Vehicle Rental (\$70/day) @ 2 days	\$140
Boat Rental (\$250/day) @ 2 days	\$500
Fixatives, coolers, etc @ 2 days	\$20

Sample analysis:

1 Biologist (\$600/day) @ 3 days	\$1,800
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Total/trip	\$5,560
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10 trips/year	\$55,600
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Report and analysis (1 Biologist, 30 days) @ \$600/day	\$18,000
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Materials required to construct spat collectors:

21 six inch Styrofoam buoys @ \$3.00 each	\$63
70 ft of 1 inch PVC pipe	\$25
21 one inch PVC quad fittings @ \$1.60 each	\$34
21 3 ft section of 3/8-inch rebar @ \$1.00 each	\$21
400 ft of 3/8-inch poly rope	\$50
5 gals liquid bleach	\$15
400 ft of 1/8 inch galvanized wire	\$20
PVC cement	\$ 8
Oyster shell	\$100

Total cost for materials	\$336
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Labor required to construct spat collectors:

Clean and prepare oyster shells	2 days
Drill holes in oyster shells	1 day
Construct shell hangers	3.5 days
Construct PVC "T" holders	0.5 days

Total	7 days
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1 Technician (\$300/day) @ 7 days	\$2,100
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Total estimated annual cost for monitoring oyster spat	\$76,036
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Estimated Cost for Monitoring Adult Oysters

1 Biologist for trip prep (\$600/day) @ 0.5 day	\$300
2 Biologist (\$800/day each) @ 2 days	\$2,400
Per diem (\$100/day) 2 biologists @ 2 days	\$400
Vehicle Rental (\$70/day) @ 2 days	\$140
Boat Rental (\$250/day) @ 2 days	\$500
Total/trip	\$3,750

2 trips/year	\$7,480
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Data analysis and Report (1 Biologist, 10days) @ \$600/day	\$6,000
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Total estimated annual cost for monitoring adult oysters	\$13,480
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TOTAL ESTIMATED ANNUAL COST FOR OYSTER MONITORING	\$89,516
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Benthic Macroinvertebrate Monitoring

Regulatory releases from Lake Okeechobee and basin run-off have been linked to muck accumulation in the St. Lucie Estuary. The implementation of CERP components is expected to significantly decrease the number of harmful regulatory releases. Accumulation and re-suspension of muck directly affects the recolonization ability of SAV and oysters and may also be triggering algal blooms within the estuary. “Hotspot” areas have been identified within the St. Lucie Estuary that support very little or no benthic organisms. Benthic organisms are considered to be good indicators of overall ecosystem health. The proposed benthic macroinvertebrate sampling would assist in both establishing a pre-construction baseline and evaluating post-construction project success.

Triplicate macroinvertebrate sampling will be conducted at thirteen sites (Figure 4) quarterly, within seven days plus or minus of a date randomly selected within each quarter (156 discrete samples per year). In order to minimize variability among triplicates, each sample will consist of a re-randomized grab within a sampling zone defined utilizing landscape ecology techniques to identify similar water depth, salinity expectations and loss on ignition to determine organic content of sediment. The midpoint of each zone is the latitude-longitude coordinates as defined in Table 3. The area of each zone shall be uniform throughout the study area and shall not exceed the area equivalent to a 100-meter circle. Samples will be collected utilizing a Van Veen stabilized ponar grab apparatus, and taxa will be identified to the lowest possible level. Samples must be collected outside of maintained channels, not from sandbars or spoil areas, and from sediments overlain by water to a depth of at least 1 meter at low tide. Granulometric and organics sampling will be conducted at every site. **One additional core should be extracted and evaluated in the field to characterize redox potential discontinuity (RPD) utilizing International Council for the Exploration of the Sea guidelines.**

Figure 4. St. Lucie Estuary Macroinvertebrate Sample Collection Sites.

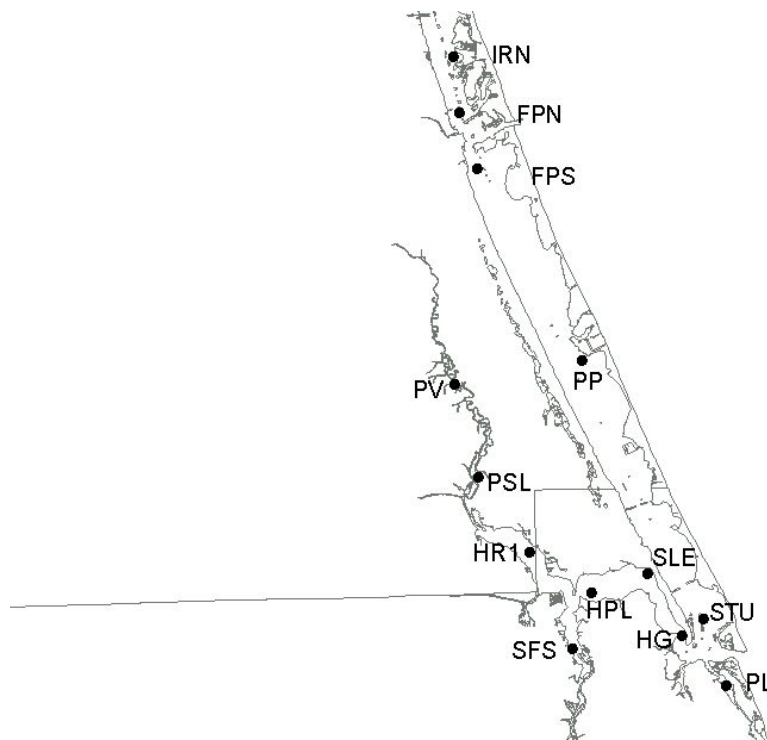


Table 3. Preliminary Site Locations for Macroinvertebrate Sampling Sites in the St. Lucie Estuary.

SITE_ID	Description	Latitude	Longitude
PV	Prima Vista Bridge NFK SLR	27.3245667	80.3337167
PSL	Port St. Lucie Blvd. NFK SLR	27.2715833	80.3202333
HR1	Telemetry Station in N Fork	27.2280300	80.2891900
SFS	South Fork SLE just south of Palm	27.1725667	80.2634833
SLE	SLE	27.2136000	80.2147500
HG	Hells Gate	27.1777700	80.1939200
HPL	Off shore hospital	27.2042000	80.2501000
PL	Pecks Lake	27.1490000	80.1666000
STU	Stuart Causeway	27.1872000	80.1799000
PP	Power Plant	27.3356000	80.2518000
FPS	Fort Pierce South	27.4461000	80.3154000
FPN	Fort Pierce North	27.4779000	80.3252000
IRN	Indian River North	27.5099000	80.3280000

Estimated Cost for Sampling and Analysis of Benthic Macroinvertebrates

Biologist	= \$600/day
Per diem	= \$100/day
Vehicle Rental	= \$70/day
Boat Rental	= 250/day
Equipment	= \$10/day for fixatives, ice, cooler
Van Veen ponar grab	= \$75/day
Benthic sample analysis	= \$800/sample
Grain size analysis	= \$50/day
Organic content analysis	= \$25/day

Monitoring cost:

1 Biologist for trip prep (\$600/day) @ 1 day	\$600
2 Biologist (\$600/day each) @ 1day	\$1,200
Vehicle Rental (\$70/day) @ 1 day	\$70
Boat Rental (\$250/day) @ 1day	\$250
Fixatives, coolers, etc (\$10/day) @ 1 day	\$10
Van Veen ponar @ \$75/day	\$75
Sample analysis (\$800/sample) @ 39 samples	\$31,200
Grain size analysis (\$50/day) @ 13 samples	\$650
Organic content analysis (\$25/day) @ 13 samples	\$325
Total/trip	\$34,380
4 trips/year	\$137,520
Report and analysis (1 Biologist, 30 days) @ \$600/day	\$18,000
Total annual monitoring cost	\$155,520

INDIAN RIVER LAGOON – SOUTH PROJECT WATER QUALITY MONITORING PLAN FOR RESERVOIRS AND STORMWATER TREATMENT AREAS

1.0 Introduction

To fulfill the water quality (WQ) requirements of the project, a monitoring plan for the CERP Indian River Lagoon South (IRL-S) project will be implemented. This monitoring plan consists of an established set of WQ parameters and monitoring locations for the project during construction and operation. IRL-S project encompasses the St. Lucie River basin located in what is known as the Upper East Coast region of the Florida peninsula. IRL-S boundaries generally follow the C-25 canal to the north; C-24, C-23, and Lake Okeechobee to the west and southwest; the C-44 canal to the south and the St. Lucie River (north and south branches) and the St. Lucie Estuary to the east. Monitoring of constructed reservoirs and stormwater treatment areas (STAs) located within the above project area shall be performed as outlined in Table 1. Both inflow and outflow of reservoirs, and inflow and outflow of STAs shall be monitored separately to allow performance of individual components to be assessed. The monitoring schedule is based upon the following four phases of facility construction and subsequent operation:

1. **Construction**
2. **Start-up** -- Period prior to initiating flow-through discharge activities. Necessary to demonstrate that the project is not a source of pollutants. This period is expected to last 6 months while not exceeding 1 year.
3. **Stabilization** -- First phase of flow-through discharge activities. Period during which vegetation is expected to grow-in and the system is settling down. Generally anticipated to last 2-3 years for STAs.
4. **Normal Flow-Through Operation** -- Long-term operational period.

1.1 Objectives of the monitoring program:

The primary objective of this monitoring plan will be to characterize the quality of water flowing immediately into and out of reservoir, STA, and Reservoir-Assisted STA (RASTA) component systems as applicable.

Additional objectives that will be considered:

1. Estimate the loads of nutrients entering a component;
2. Estimate the loads of nutrients leaving a component area;
3. Detect and evaluate sources of pesticides and other pollutants entering and leaving a component area;
4. Determine compliance with appropriate water quality standards;
5. Document toxicological impacts to aquatic life that may result from operation of the project.

2.0 Monitoring Plan

The monitoring plan will ensure that the project components are in compliance with the water quality conditions of the water quality certification (WQC) and that the project meets all applicable State water quality standards as required by Section 1341 of the Clean Water Act. This monitoring plan has been designed to verify that no project components cause or contribute to violation of state water quality standards. The monitoring plan addresses three categories of media: (1) Surface Water, (2) Sediment, and (3) Fish Tissue. The discussion that follows describes the initial suite of analytes for which each medium is to be tested.

2.1 Surface Water

Surface water monitoring sites at inflow and outflow points will be selected to monitor water quality immediately upstream and in the discharge of project components. The number of collection will be established at a future date and will be contingent on whether or not associated reservoirs and STAs as independent or co-located (i.e., RASTA). During operations, these sites will be monitored for field and physical parameters, nutrients, metals, and pesticides with a frequency not to exceed a monthly basis. Specifically, mercury in surface water will be monitored quarterly. More frequent monitoring may be implemented for certain parameters during the Start-up as baseline conditions indicate.

2.2 Sediment

Sediment core samples shall be collected at representative sites within project components. These cores shall be tested for total mercury (THg), methylmercury, acid volatile sulfides, moisture content, TOC, and trace metals (aluminum, copper, iron, and zinc). The purpose of the sediment testing is to determine if, and under what conditions, components will impact the formation of methylmercury.

2.3 Fish

Mosquitofish will be sampled on a quarterly basis at interior sites of components and be analyzed for THg. Largemouth Bass and Sunfish will be collected annually and analyzed in sets of 5 samples, if sufficient quantities are available. The testing schedule for fish tissue is shown in Table 1.

The frequency of collection and parameters may change as information is obtained. This flexibility allows for the modification of the parameters list to either include other parameters or exclude existing parameters as deemed necessary. Monitoring sites may also be added or deleted as long-term water quality is evaluated. A minimum of one year's worth of data, for those parameters being sampled at least quarterly, will be utilized to determine if modification to the monitoring program is warranted. Table 2.1 lists the suggested parameters and frequencies for each sampling media.

TABLE 1. Summary of monitoring program for reservoirs and STAs in the Indian River Lagoon – South subcomponent of CERP. Detection limits for analytes per FDEP “Table as Required by Rule 62-4.246(4), Testing Methods for Discharges to Surface Waters”.

Medium	Group	Parameters	Construction	Startup	Stabilization	Normal Flow-Through
Water	Field Parameters	Dissolved oxygen, conductivity, pH, temperature,		Probe, Bi-weekly, at inflow and outflow	Probe, Monthly, at inflow and outflow	Probe, Monthly, at inflow and outflow*
Water	Nutrients	TP, TRP (total reactive ortho-P), TKN, NH ₃ , NO ₂₊₃		Grab, monthly, at inflow and outflow	Grab, Monthly, at inflow and outflow	Grab, Monthly, at inflow and outflow
Water	Physical	Alkalinity, Chloride, Hardness, turbidity, TSS, color	Turbidity only*	Grab, Monthly at inflow and outflow	Grab, Monthly at inflow and outflow	Grab, Monthly, at inflow and outflow*
Water	Trace Metals	Cu		Grab, at end of startup, at inflow and outflow	Grab, Monthly at inflow and outflow	Grab, Monthly at inflow and outflow**
Water	Trace Metals	As, Fe, Zn		Grab, at end of startup, at inflow and outflow	Grab, Quarterly, at inflow and outflow	Grab, Quarterly, at inflow and outflow
Water	Pesticides +	W-PEST-CL, W-PEST-NP, W-CARB, W-UHERB-MS, W-WSOL-NP		Grab, at end of startup, at inflow and outflow	Grab, at end of stabilization, at inflow and outflow	Grab, quarterly, at inflow and outflow**
Water	Mercury +	Total Mercury and Methylmercury		Grab, monthly at inflow and midpoint	Grab, Quarterlyly at inflow and outflow	Grab, Quarterly at inflow and outflow**
Fish Tissue	Mercury +	Mercury			Quarterly, 100 mosquitofish at interior sites and one downstream site; Annually, Five or more Sunfish and 5 or more largemouth bass, at interior sites and one downstream site	Quarterly, 100 mosquitofish at interior sites and one downstream site; Annually, Five or more Sunfish and 5 or more largemouth bass, at interior sites and one downstream site
Sediment	Mercury +	Total Mercury, Methylmercury, Acid volatile sulfides, moisture content, TOC	Prior to flooding, soil cores (0-4 cm horizon) at 6 representative interior sites			
Sediment-	Trace Metals	Al, Cu, Fe, and Zn		none	soil cores, at end of stabilization, at inflow and outflow	soil cores, Annually, at inflow and outflow**

** During the first year, and frequency adjusted accordingly thereafter dependent upon examination of data

+ Mercury and pesticide monitoring may be modified dependent on acceptance of the Draft CGM for these contaminants.

ESTIMATED COSTS FOR WQ MONITORING OF RESERVOIRS AND STAs

START-UP PHASE ONLY

C-44 Basin

Sample analysis	\$27,192
Field work	\$24,056
Report preparation	\$9,692
Travel costs	\$9,912
Labor costs	\$23,352
Total Costs	\$94,204

C-23/24 Basin

Sample analysis	\$23,644
Field work	\$24,056
Report preparation	\$9,692
Travel costs	\$9,912
Labor costs	\$22,176
Total Costs	\$89,480

C-25 Basin

Sample analysis	\$15,538
Field work	\$24,056
Report preparation	\$9,692
Travel costs	\$9,912
Labor costs	\$21,000
Total Costs	\$80,198

The start-up phase will occur after construction, prior to initiating normal flow-through discharge activities. This phase is expected to last 6 months to 1 year. The total costs above for each basin reflect a 1-year period. If the start-up phase for any basin is less than 1 year, the total cost for monitoring during that phase will be lower.

STABILIZATION AND NORMAL FLOW-THROUGH PHASES

C-44 Basin

Sample analysis	\$99,228
Field work	\$92,892
Report preparation	\$9,692
Travel costs	\$9,912
Labor costs	\$77,838
Total Costs	\$289,562

C-23/24 Basin

Sample analysis	\$75,588
Field work	\$92,892
Report preparation	\$9,692
Travel costs	\$9,912
Labor costs	\$73,918
Total Costs	\$262,002

C-25 Basin

Sample analysis	\$53,610
Field work	\$92,892
Report preparation	\$9,692
Travel costs	\$9,912
Labor costs	\$69,998
Total Costs	\$236,104

The total costs above for each basin are the annual costs for monitoring during the stabilization and normal flow-through operation phases. Once the reservoirs and STAs are constructed and operational for all basins, the estimated annual cost for water quality monitoring would be \$787,668

Resource Inventories

Scientific name	Common name	Occurrence on Allapattah
BIRDS		
<i>Phalacrocorax auritus</i>	Double-crested Cormorant	x
<i>Anhinga anhinga</i>	Anhinga	x
<i>Ardea herodias</i>	Great Blue Heron	x
<i>Ardea alba</i>	Great Egret	x
<i>Egretta thula</i>	Snowy Egret	x
<i>Egretta caerulea</i>	Little Blue Heron	x
<i>Egretta tricolor</i>	Tricolored Heron	x
<i>Egretta rufescens</i>	Reddish Egret	?
<i>Bubulcus ibis</i>	Cattle Egret	x
<i>Nyctanassa violacea</i>	Yellow-crowned Night Heron	x
<i>Butorides virescens</i>	Green Heron	x
<i>Eudocimus albus</i>	White Ibis	x
<i>Plegadis falcinellus</i>	Glossy Ibis	x
<i>Mycteria americana</i>	Wood Stork	x
<i>Coragyps atratus</i>	Black Vulture	x
<i>Cathartes aura</i>	Turkey Vulture	x
<i>Anas fulvigula</i>	Mottled Duck	x
<i>Lophodytes cucullatus</i>	Hooded Merganser	x
<i>Pandion haliaetus</i>	Osprey	x
<i>Circus cyaneus</i>	Northern Harrier	x
<i>Accipiter cooperii</i>	Cooper's Hawk	x
<i>Buteo lineatus</i>	Red-shouldered Hawk	x
<i>Buteo jamaicensis</i>	Red-tailed Hawk	x
<i>Caracara cheriway</i>	Crested Caracara	x
<i>Falco sparverius</i>	American Kestrel	x
<i>Chordeiles minor</i>	Common Nighthawk	x
<i>Caprimulgus carolinensis</i>	Chuck-will's-widow	x
<i>Colinus virginianus</i>	Northern Bobwhite	x
<i>Porphyrio martinica</i>	Purple Gallinule	x
<i>Gallinula chloropus</i>	Common Moorhen	x
<i>Grus canadensis</i>	Sandhill Crane	x
<i>Charadrius vociferus</i>	Killdeer	x
<i>Tringa flavipes</i>	Lesser Yellowlegs	x
<i>Gallinago gallinago</i>	Common Snipe	x
<i>Zenaida macroura</i>	Mourning Dove	x
<i>Columbina passerina</i>	Common Ground-Dove	x
<i>Ceryle alcyon</i>	Belted Kingfisher	x
<i>Melanerpes carolinus</i>	Red-bellied Woodpecker	x
<i>Picoides pubescens</i>	Downy Woodpecker	x
<i>Colaptes auratus</i>	Northern Flicker	x
<i>Dryocopus pileatus</i>	Pileated Woodpecker	x
<i>Sayornis phoebe</i>	Eastern Phoebe	x
<i>Myiarchus crinitus</i>	Great Crested Flycatcher	x
<i>Tyrannus tyrannus</i>	Eastern Kingbird	x
<i>Lanius ludovicianus</i>	Loggerhead Shrike	x
<i>Vireo griseus</i>	White-eyed Vireo	x
<i>Cyanocitta cristata</i>	Blue Jay	x
<i>Corvus brachyrhynchos</i>	American Crow	x

Scientific name	Common name	Occurrence on Allapattah
<i>Corvus ossifragus</i>	Fish Crow	x
<i>Tachycineta bicolor</i>	Tree Swallow	x
<i>Thryothorus ludovicianus</i>	Carolina Wren	x
<i>Cistothorus platensis</i>	Sedge Wren	x
<i>Poliophtila caerulea</i>	Blue-gray Gnatcatcher	x
<i>Turdus migratorius</i>	American Robin	x
<i>Dumetella carolinensis</i>	Gray Catbird	x
<i>Mimus polyglottos</i>	Northern Mockingbird	x
<i>Toxostoma rufum</i>	Brown Thrasher	x
<i>Sturnus vulgaris</i>	European Starling	x
<i>Dendroica coronata</i>	Yellow-rumped Warbler	x
<i>Dendroica palmarum</i>	Palm Warbler	x
<i>Geothlypis trichas</i>	Common Yellowthroat	x
<i>Pipilo erythrophthalmus</i>	Eastern Towhee	x
<i>Passerculus sandwichensis</i>	Savannah Sparrow	x
<i>Ammodramus savannarum</i>	Grasshopper Sparrow (non-FL ssp)	x
<i>Aimophila aestivalis</i>	Bachman's Sparrow	x
<i>Melospiza georgiana</i>	Swamp Sparrow	x
<i>Cardinalis cardinalis</i>	Northern Cardinal	x
<i>Agelaius phoeniceus</i>	Red-winged Blackbird	x
<i>Sturnella magna</i>	Eastern Meadowlark	x
<i>Quiscalus quiscula</i>	Common Grackle	x
<i>Quiscalus major</i>	Boat-tailed Grackle	x
<i>Molothrus ater</i>	Brown-headed Cowbird	x
<i>Parus atricapillus</i>	Black capped chickadee	
<i>Strix varia</i>	Barred Owl	
<i>Athena cunicularia floridana</i>	Burrowing Owl	x
<i>Ajaja ajaja</i>	Roseate Spoonbill	x
<i>Elanoides forficatus</i>	Swallow-tailed kite	x
<i>Bubo virginianus</i>	Great horned owl	x
<i>Meleagris gallopavo</i>	Wild turkey	x
<i>Himantopus mexicanus</i>	Black necked stilt	x
	Yellow bellied sapsucker	
	Pied billed grebe	
FISHES		x
<i>Heterandria formosa</i>	least killifish	x
<i>Gambusia holbrooki</i>	mosquitofish	x
<i>Neotoma floridana</i>	eastern woodrat	x
<i>Lepisosteus platyrhincus</i>	Florida gar	x
<i>Micropterus salmoides</i>	largemouth bass	x
AMPHIBIANS		
<i>Hyla cinerea</i>	green tree frog	x
<i>Rana utricularia</i>	southern leopard frog	x
<i>Rana grylio</i>	pig frog	x
<i>Bufo quercicus</i>	oak toad	x
REPTILES		
<i>Alligator mississippiensis</i>	American alligator	x
<i>Drymarchon corais couperi</i>	eastern indigo snake (skin)	x

Scientific name	Common name	Occurrence on Allapattah
<i>Coluber constrictor constrictor</i>	black racer	x
MAMMALS		
<i>Odocoileus virginianus</i>	white tailed deer	x
<i>Dasypus novemcinctus</i>	armadillo	x
<i>Procyon lotor</i>	raccoons	x
<i>Sciurus niger</i>	eastern fox squirrel	x
INVERTEBRATES		
<i>Odonata</i>	damselflies	x
<i>Odonata</i>	dragonflies	x
<i>Hemiptera</i>	water beetles	x
<i>Procambarus sp.</i>	crayfish	x
<i>Pomacea paludosa</i>	apple snail	x
<i>Danaus gilippus</i>	queen butterfly	x

PLANTS

Scientific Name	Common Name	Present on Allapattah
<i>Acer rubrum</i>	Red maple	X
<i>Acrostichum danaeifolium</i>	Leather fern	X
<i>Aletris lutea</i>	Yellow colic root	X
<i>Alternanthera philoxeroides</i>	Alligator weed	X
<i>Amphicarpum</i>		X
<i>Andropogon glomeratus</i>	Broom sedge	X
<i>Andropogon virginicus</i>	Chalky bluestem	X
<i>Aristida speciformis</i>	Wire grass	X
<i>Asclepias curassavica</i>	Scarlet milkweed	X
<i>Asimina sp.</i>	Pawpaw	X
<i>Azolla sp.</i>		X
<i>Baccharis halimifolia</i>	Salt bush	X
<i>Bacopa caroliniana</i>	Lemon bacopa	X
<i>Bacopa monnieri</i>	Water hyssop	X
<i>Befaria racemosa</i>	Tarflower	X
<i>Blechnum serrulatum</i>	Swamp fern	X
<i>Callicarpa americana</i>	Beauty berry	X
<i>Cephalanthus occidentalis</i>	Buttonbush	X
<i>Cirsium horridulum</i>	Thistle	X
<i>Cladium jamaicense</i>	Sawgrass	X
<i>Commelina sp.</i>	Common day flower	X
<i>Coreopsis sp.</i>	Tickseed	X
<i>Cyperus spp.</i>	Sedge	X
<i>Distichylis sp.</i>		X
<i>Drosera sp.</i>	Sundew	X
<i>Echihornia crassipes</i>	Water hyacinth	X
<i>Eleocharis baldwinii</i>	Hairgrass	X
<i>Eleocharis cellulosa</i>	Spikerush	X
<i>Eleocharis interstincta</i>	Jointed spikerush	X
<i>Eriocaulon compressum</i>	Hatpins	X
<i>Eupatorium sp.</i>	Dog fennel	X
<i>Ficus aurea</i>	Strangler fig	X
<i>Flaveria linearis</i>	Yellowtop	X
<i>Furiera sp.</i>		X
<i>Gordonia lasianthus</i>	Loblolly bay	X
<i>Hydrocotyl sp.</i>	Pennywort, dollarweed	X
<i>Hypericum sp.</i>	St. John's wort	X
<i>Hibiscus grandiflora</i>	Wild hibiscus	X
<i>Ilex cassine</i>	Dahoon holly	X
<i>Ilex glabra</i>	gallberry	X
<i>Juncus effusus</i>	Soft rush	X
<i>Lachnanthes caroliniana</i>	Redroot	X
<i>Lachnocaulon anceps</i>	Bog buttons	X
<i>Lantana sp.</i>	Lantana	X

Scientific Name	Common Name	Present on Allapattah
<i>Lemna minor</i>	Duckweed	x
<i>Lilium catesbaei</i>	Pine lily	x
<i>Lithospermum caroliniense</i>	Puccoon	x
<i>Lobelia sp.</i>	Lobelia	x
<i>Ludwigia peruviana</i>	Primrose willow	x
<i>Ludwigia repens</i>	Red ludwigia	x
<i>Ludwigia sp.</i>	Ludwigia	x
<i>Lygodium microphyllum</i>	Old world climbing fern	x
<i>Magnolia virginiana</i>	Sweet bay	x
<i>Melothria pendul</i>	Creeping cucumber	x
<i>Mikania scandens</i>	Climbing hempweed	x
<i>Mormordica charantia</i>	Wild balsam apple	x
<i>Myrica cerifera</i>	Wax Myrtle	x
<i>Osmunda cinnomomea</i>	Cinnamon fern	x
<i>Osmunda regalis</i>	Royal fern	x
<i>Oxypolis sp.</i>	Water dropwort	x
<i>Panicum erectum</i>		x
<i>Panicum hemitomom</i>	Maidencane	x
<i>Panicum repens</i>	Torpedo grass	x
<i>Panicum sp.</i>		x
<i>Persea palustris</i>	Swamp bay	x
<i>Pinus elliotii</i>	Slash pine	x
<i>Pistia stratiotes</i>	Water lettuce	x
<i>Phyla nodiflora</i>	Matchweed	x
<i>Phytolaca</i>	Pokeweed	x
<i>Pluchea odorata</i>	Camphor weed	x
<i>Pontederia cordata</i>	Pickerelweed	x
<i>Polygala cymosa</i>	Tall milkwort	x
<i>Polygala sp.</i>	Bachelor button	x
<i>Polygonum sp.</i>	Smartweed	x
<i>Proserpinaca sp.</i>	Mermaid weed	x
<i>Pterocaulon pycnostachyum</i>	Blackroot	x
<i>Quercus virginiana</i>	Live oak	x
<i>Quercus sp.</i>	Oak (laurel?)	x
<i>Rhexia virginica</i>	Meadow beauty	x
<i>Rhynchospora tracyi</i>	Beak rush	x
<i>Rhynchospora haspens</i>	Beak rush	x
<i>Rhynchospora sp.</i>		x
<i>Rubus sp.</i>	Dewberry, blackberry	x
<i>Rudbeckia hirta</i>	Black-eyed susan	x
<i>Sabal palmetto</i>	Sabal palm, cabbage palm	x
<i>Sabatia grandiflora</i>	Marsh Pink	x
<i>Sacoila lanceolata</i>	Frost flowered neottia/leafless beaked orchid	x
<i>Sagittaria sp.</i>	Duck potato	x
<i>Salix caroliniana</i>	Coastal plains willow	x
<i>Sambucus simpsonii</i>	Elderberry	x

Scientific Name	Common Name	Present on Allapattah
<i>Sarcostema clausa</i>	White vine	x
<i>Schinus terebinthefolius</i>	Brazilian pepper	x
<i>Serenoa repens</i>	Saw palmetto	x
<i>Sesbania sp.</i>	Sesban	x
<i>Shrankia microphylla</i>	Sensitive briar	x
<i>Sisyrinchium atlanticum</i>	Blue eyed grass	x
<i>Solidago fistulosa</i>	Goldenrod	x
<i>Spiranthes sp.</i>	Lawn orchid	x
<i>Spartina bakerii</i>	Cordgrass	x
<i>Stillingia aquatica</i>	Corkwood, Queen's Delight	x
<i>Taxodium distichum</i>	Bald cypress	x
<i>Thalia geniculata</i>	Alligator flag	x
<i>Thelypteris sp.</i>	Marsh fern	x
<i>Tillandsia sp.</i>	Air plant	x
<i>Tillandsia usneoides</i>	Spanish moss	x
<i>Toxicodendron radicans</i>	Poison ivy	x
<i>Urena lobata</i>	Caesarweed	x
<i>Utricularia cornuta</i>	Horned bladderwort	x
<i>Utricularia purpurea</i>	Purple bladderwort	x
<i>Utricularia sp.</i>	Bladderwort	x
<i>Vitis sp.</i>	Wild grape	x
<i>Woodwardia virginica</i>	Virginia chain fern	x
<i>Xyris sp.</i>	Yellow-eyed grass	x